PRECIPITATION TYPES

YOU NEED TO KNOW
BEFORE YOU
GET WET

CONTENT

- FORCASTING PRECIPITATION TYPES
- SINGLE FREEZING LEVEL
- MULTIPLE FREEZING LEVELS
- FREEZING PRECIPITATION TYPES

CONTENT

- SYNOPTIC PATTERNS
  - WARM FRONT
  - STATIONARY FRONT
  - COLD FRONT
- METHOD OF FORECASTING FREEZING PRECIPITATION
- HEAVY SNOW

CONTENT

- HEAVY SNOW SYNOPTIC SITUATIONS
  - BAROCLINIC NON-OCCLUDING LOW
  - BAROCLINIC DEEP-OCCLUDING LOW
  - POST COLD FRONTAL TROUGH
  - WARM ADVECTION
  - INVERTED TROUGH

CONTENT

- 200 MB SNOW INDEX
- SUMMARY

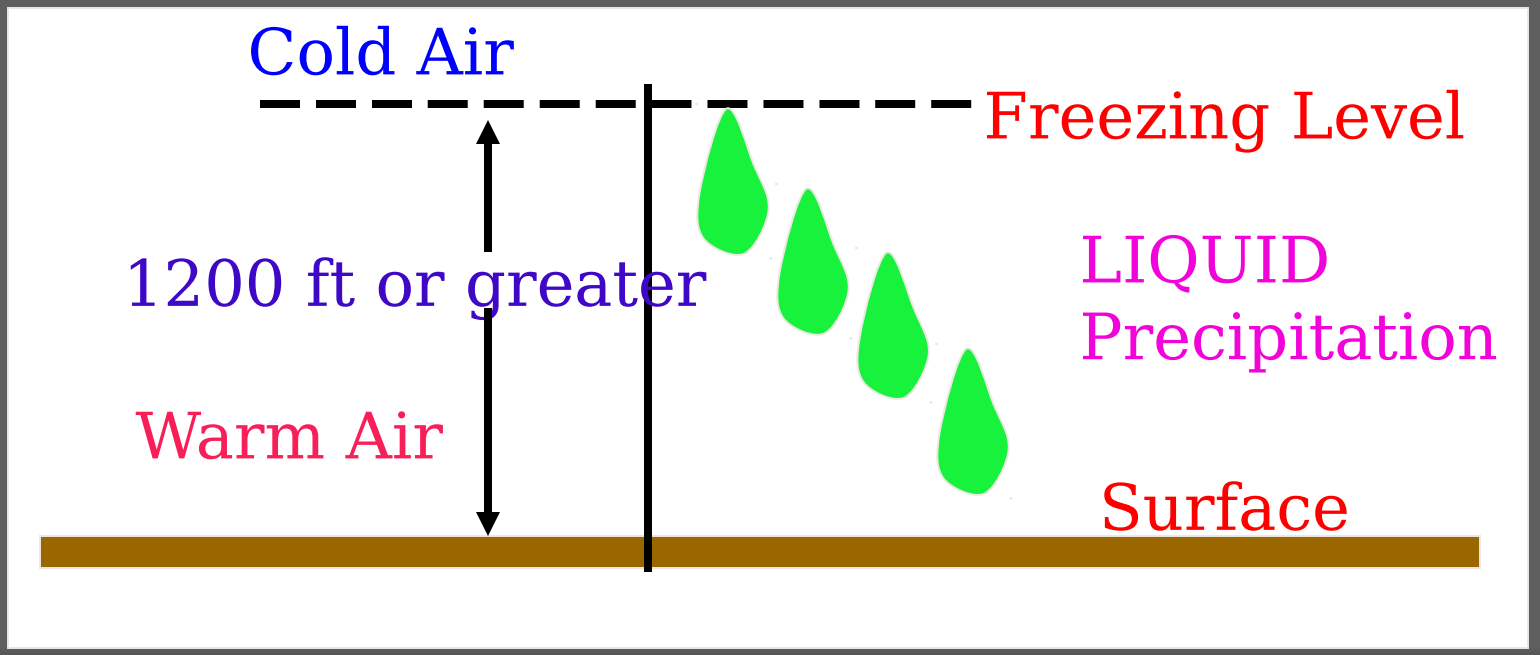
FORCASTING PRECIPITATION TYPES

- To forecast precipitation, you must also forecast the temperature, atmospheric stability, availability of moisture and the cloud types.

- The type of precipitation seen will depend on the height of the freezing level and the depth of the warm layer aloft.

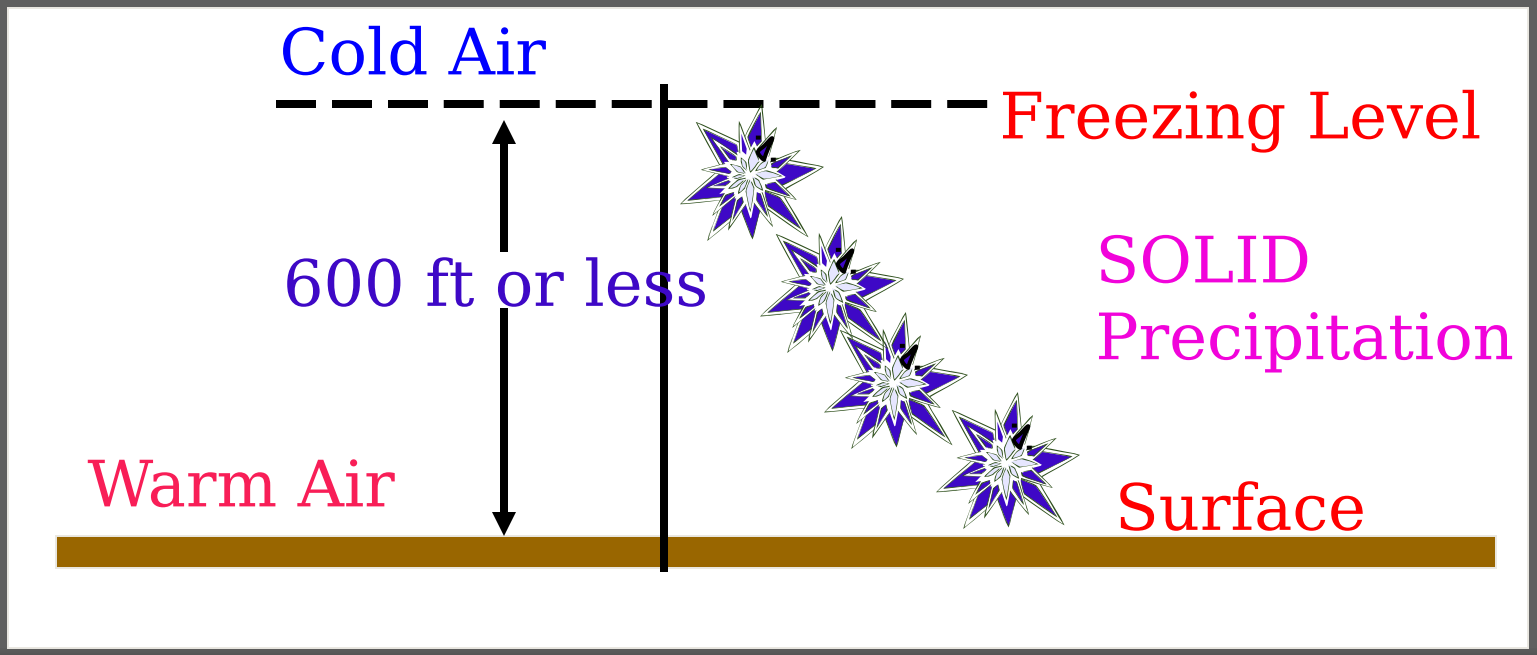
SINGLE FREEZING LEVEL

- If the freezing level closest to the surface is ≥ 1,200 ft AGL, forecast liquid precipitation.



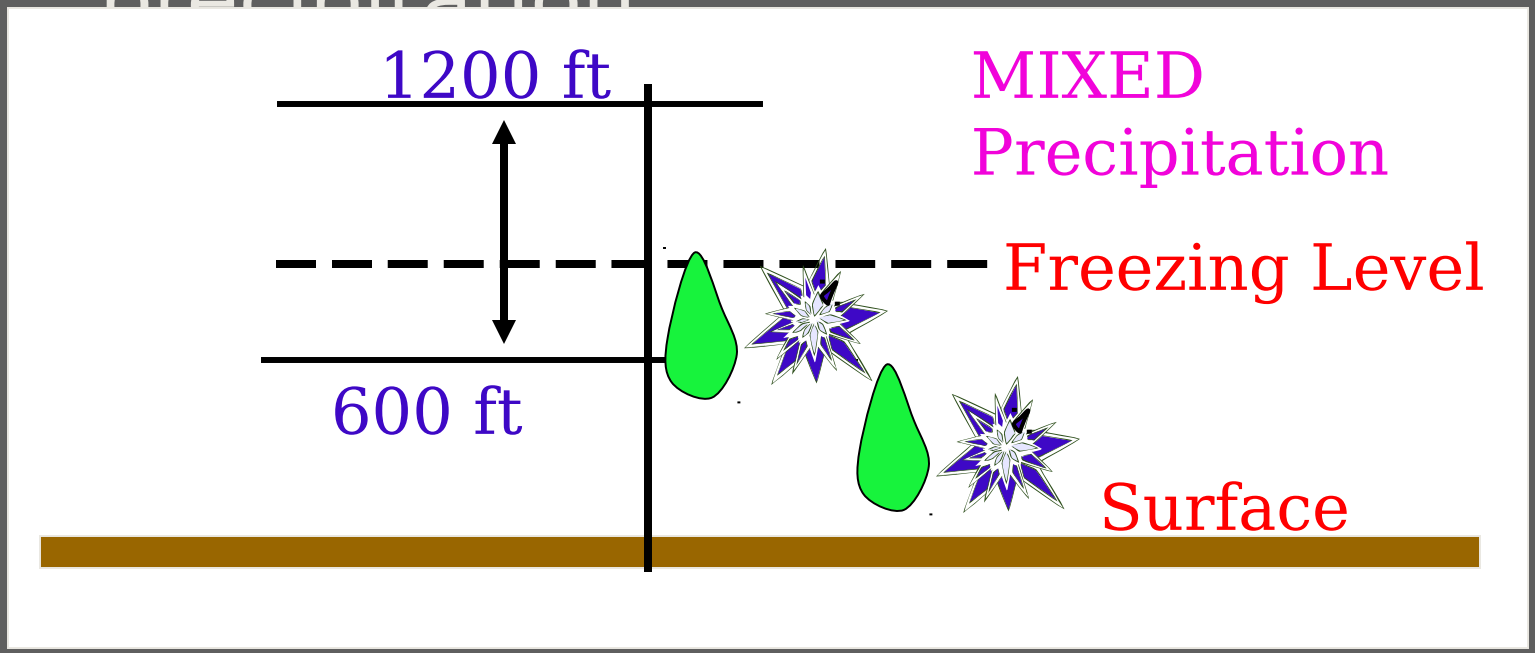
SINGLE FREEZING LEVEL

- If the freezing level closest to the surface is $\leq$ 600 ft AGL, forecast solid precipitation.



SINGLE FREEZING LEVEL

- If the freezing level closest to the surface is between 600 ft and 1,200 AGL, forecast mixed precipitation



SINGLE FREEZING LEVEL

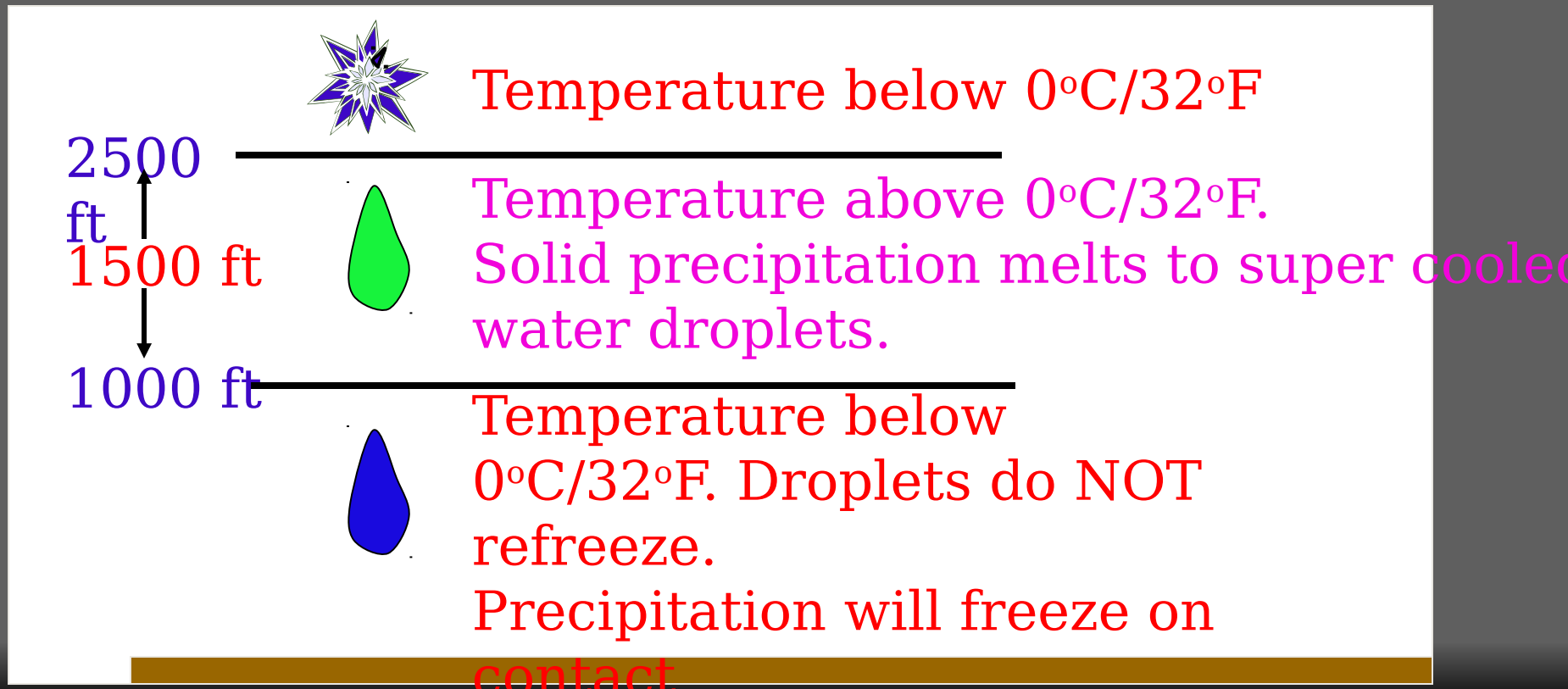
- There are many ways to determine the freezing level in your area:
  - Skew-T's
  - NEXRAD base reflectivity
  - Freezing level charts
  - Upper air charts (may only give you a general idea).
  - PIREPS

MULTIPLE FREEZING LEVELS

- Multiple freezing levels exist when you have two cold layers with a warm layer (melting layer) between them.
- All precipitation is going to start as solid (snow) precipitation because it all is formed in the cold air mass.

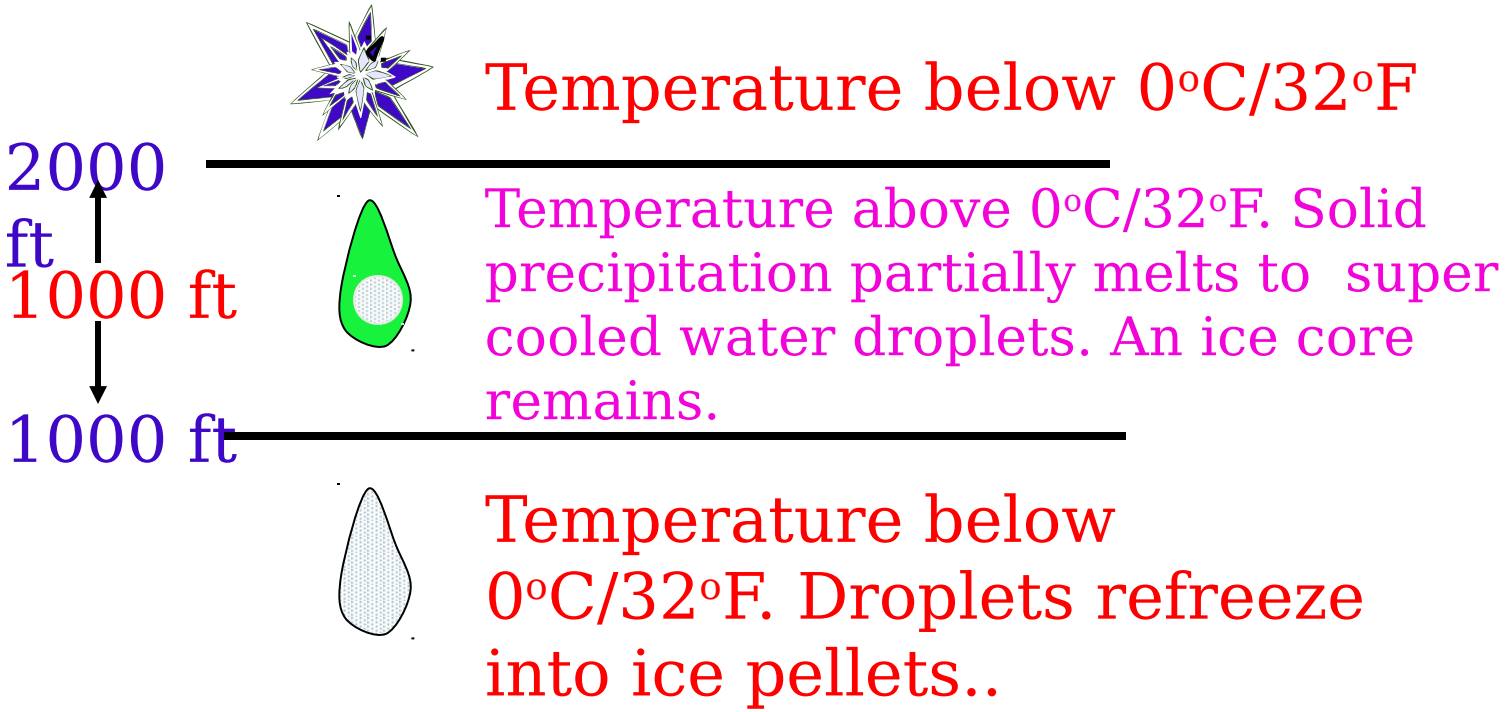
MULTIPLE FREEZING LEVELS

- If the warm layer is > 1200 ft thick, forecast freezing rain.


Temperature below 0°C/32°F
2500 ft
1500 ft
1000 ft
Temperature above 0°C/32°F. Solid precipitation melts to super cooled water droplets.
Temperature below 0°C/32°F. Droplets do NOT refreeze.
Precipitation will freeze on contact

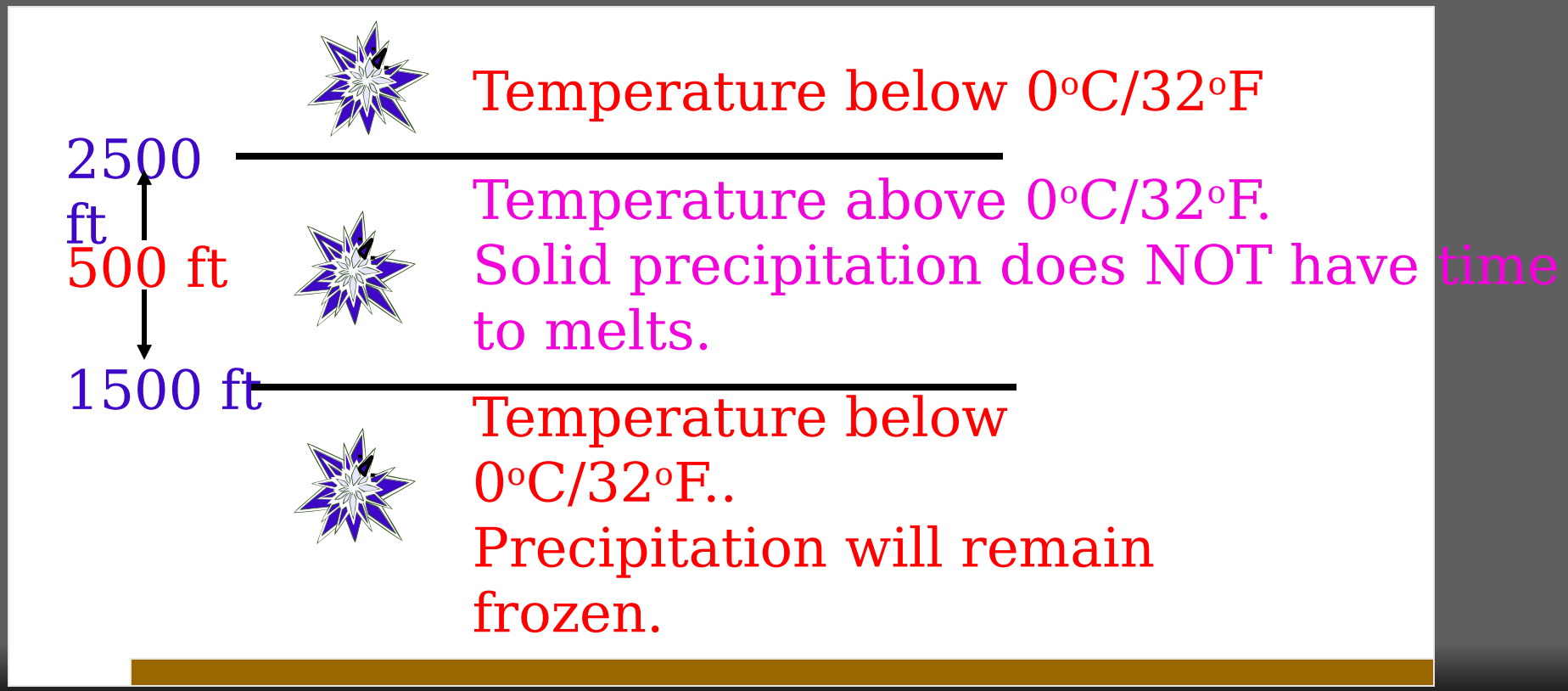
MULTIPLE FREEZING LEVELS

- If the warm layer is between 600 – 1200 ft thick, forecast ice pellets.


Temperature below 0°C/32°F
2000 ft
1000 ft
1000 ft
Temperature above 0°C/32°F. Solid precipitation partially melts to super cooled water droplets. An ice core remains.
Temperature below 0°C/32°F. Droplets refreeze into ice pellets..

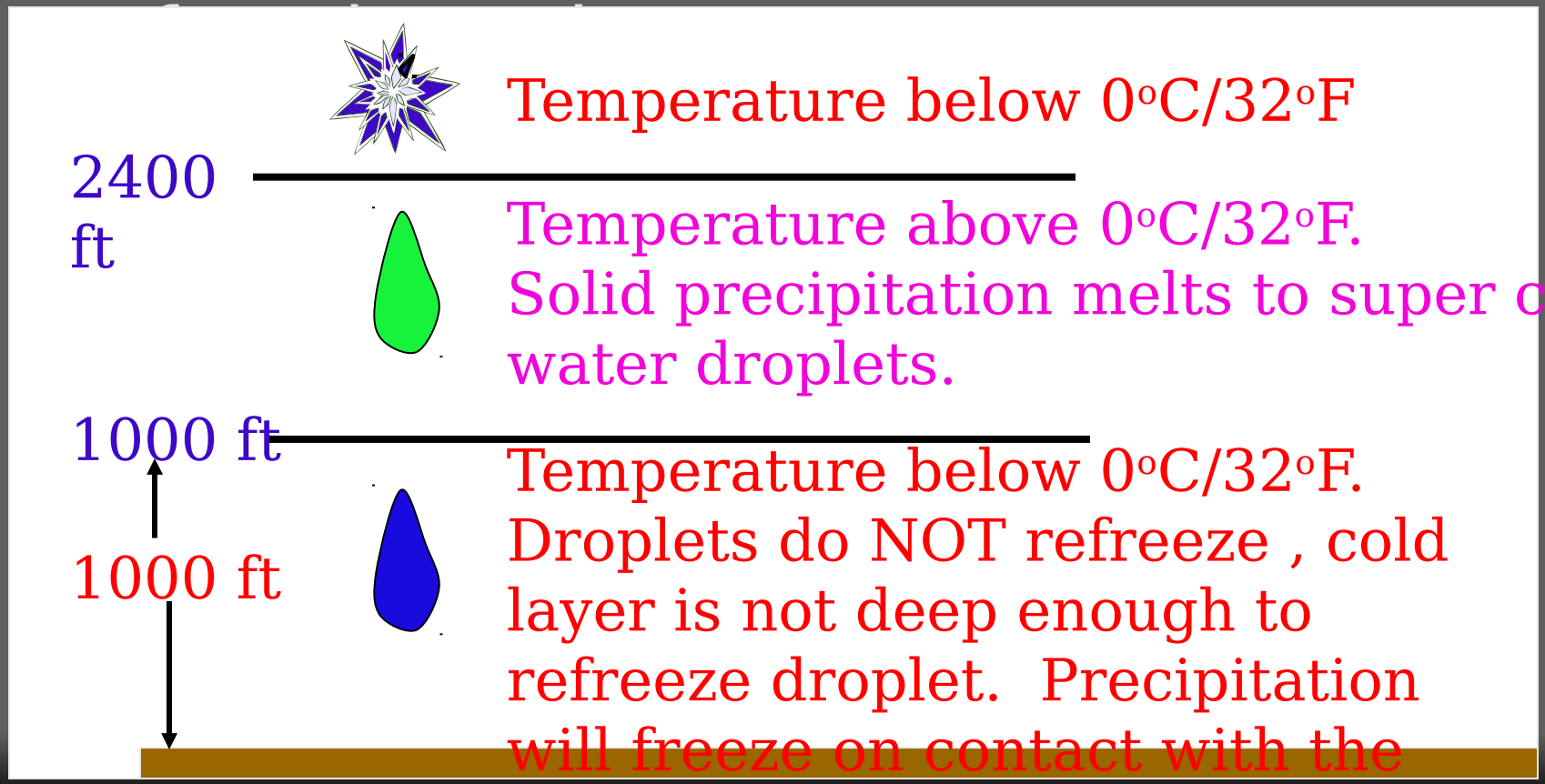
MULTIPLE FREEZING LEVELS

- If the warm layer is > than 600 ft thick, forecast snow.



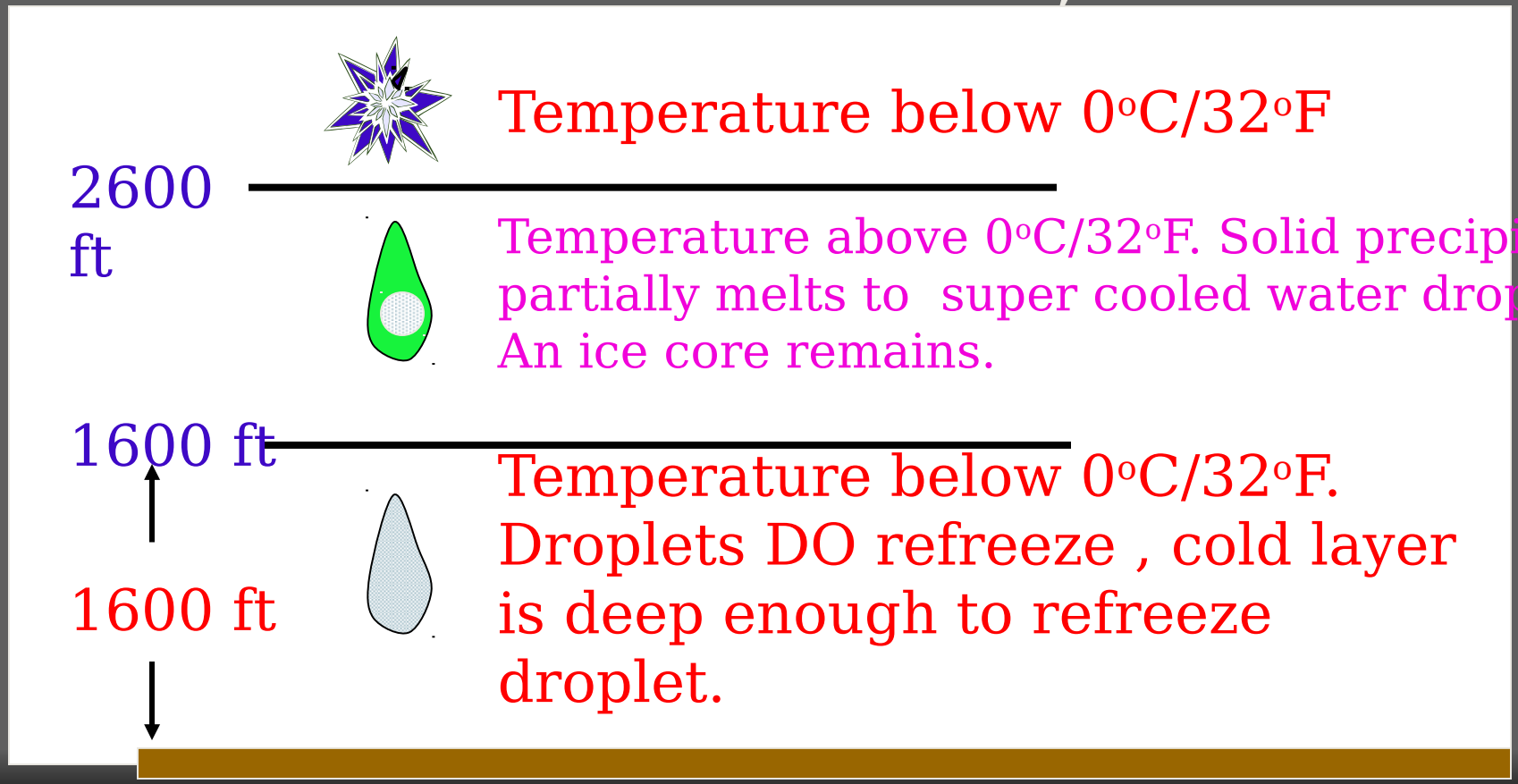
MULTIPLE FREEZING LEVELS

- If the cold layer closest to the surface is ≤ 1500 ft AGL, forecast


Temperature below 0°C/32°F
2400 ft
Temperature above 0°C/32°F.
Solid precipitation melts to super cooled water droplets.
1000 ft
Temperature below 0°C/32°F.
Droplets do NOT refreeze , cold layer is not deep enough to refreeze droplet. Precipitation will freeze on contact with the
1000 ft

MULTIPLE FREEZING LEVELS

- If the cold layer closest to the surface is >1500 ft AGL, forecast

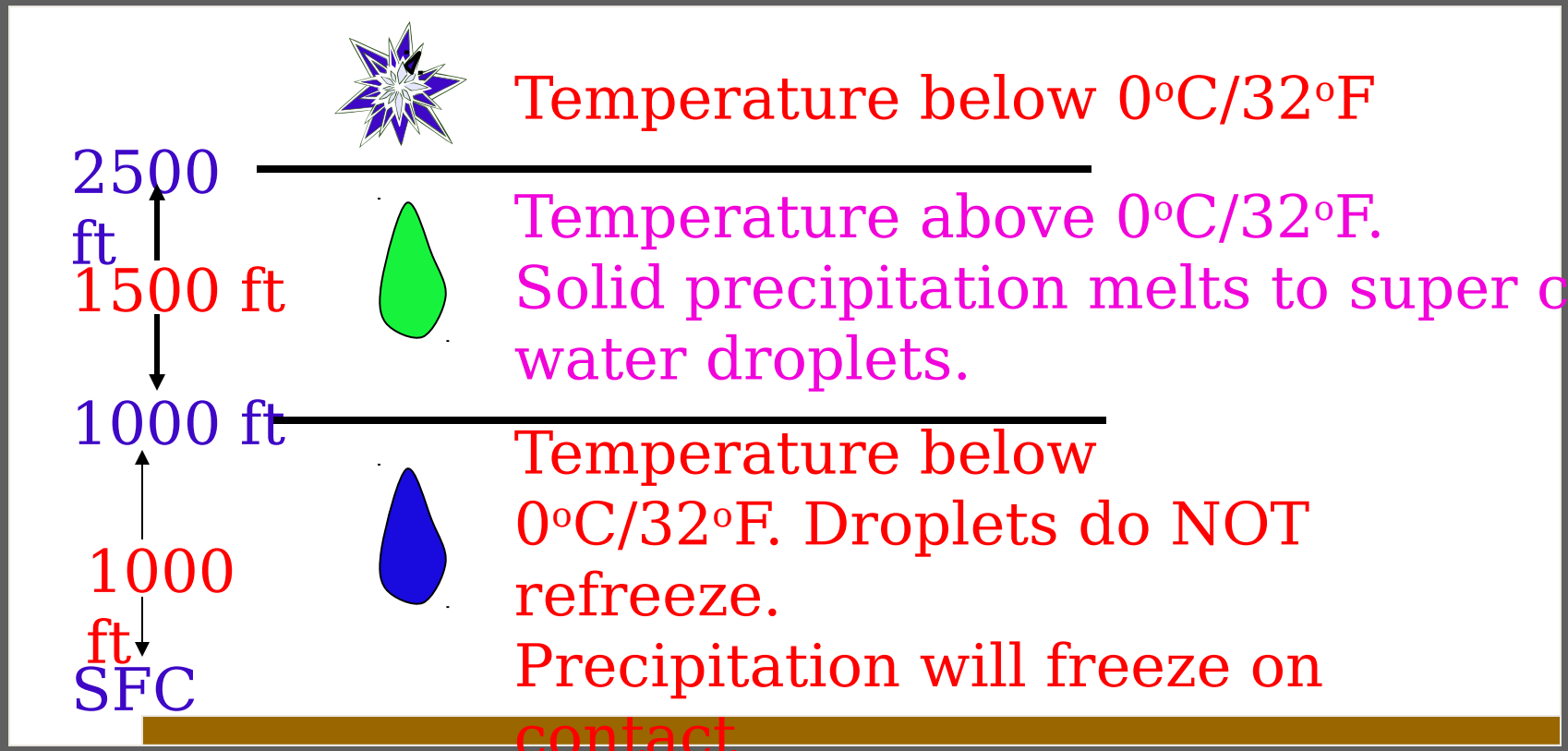

Temperature below 0°C/32°F
2600 ft
Temperature above 0°C/32°F. Solid precipitation partially melts to super cooled water droplets. An ice core remains.
1600 ft
Temperature below 0°C/32°F. Droplets DO refreeze , cold layer is deep enough to refreeze droplet.
1600 ft

MULTIPLE FREEZING LEVELS

- If the warm layer is > 1200 ft and the cold layer is $\leq$ 1500 ft, forecast freezing rain.
- If the warm layer is between 600 and 1200, ft and the cold layer is > 1500 ft, forecast ice pellets.
- If the warm layer is < 600 ft and the cold layer > 1500 ft, forecast snow.

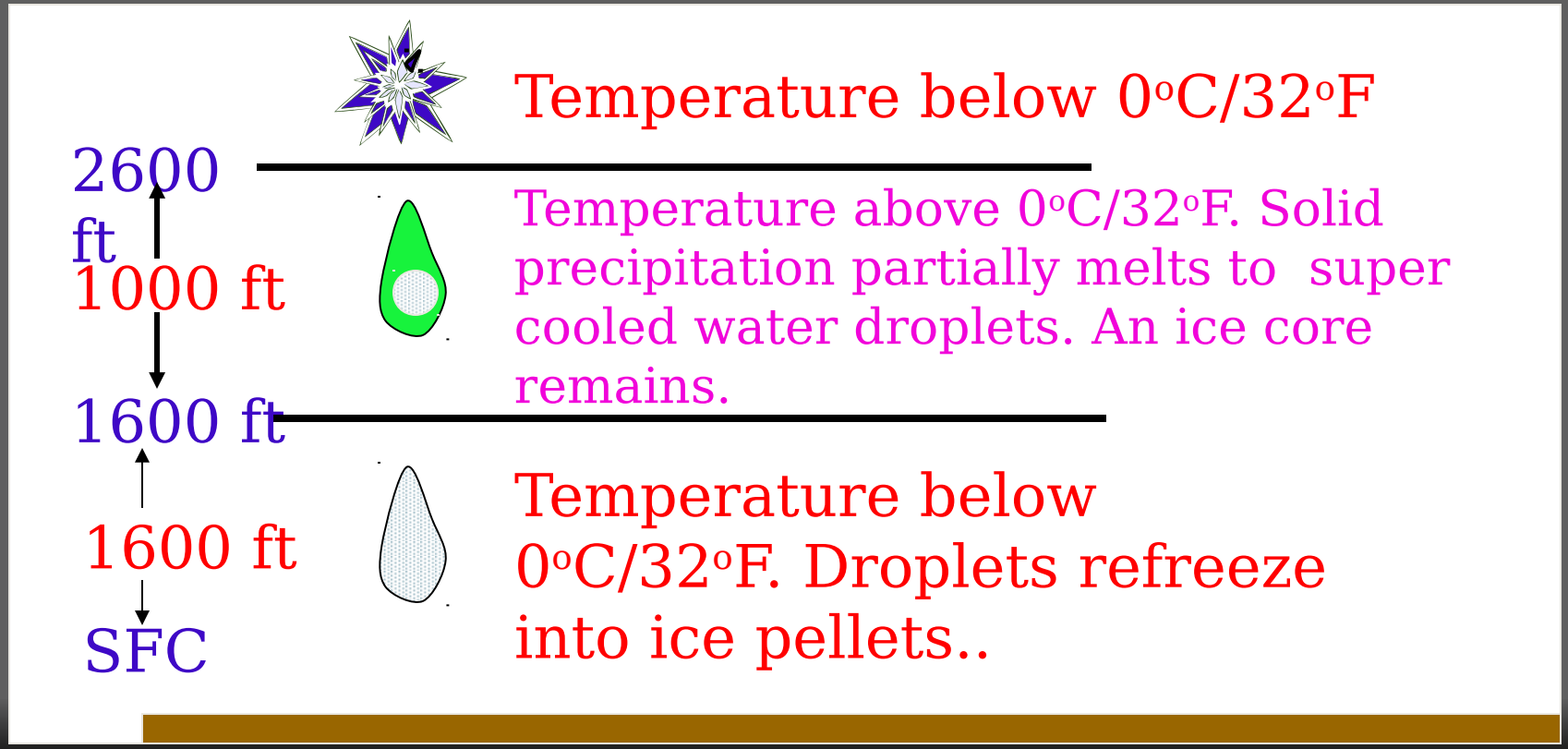
MULTIPLE FREEZING LEVELS

Warm layer > 1200 ft, cold layer ≤ 1500 ft



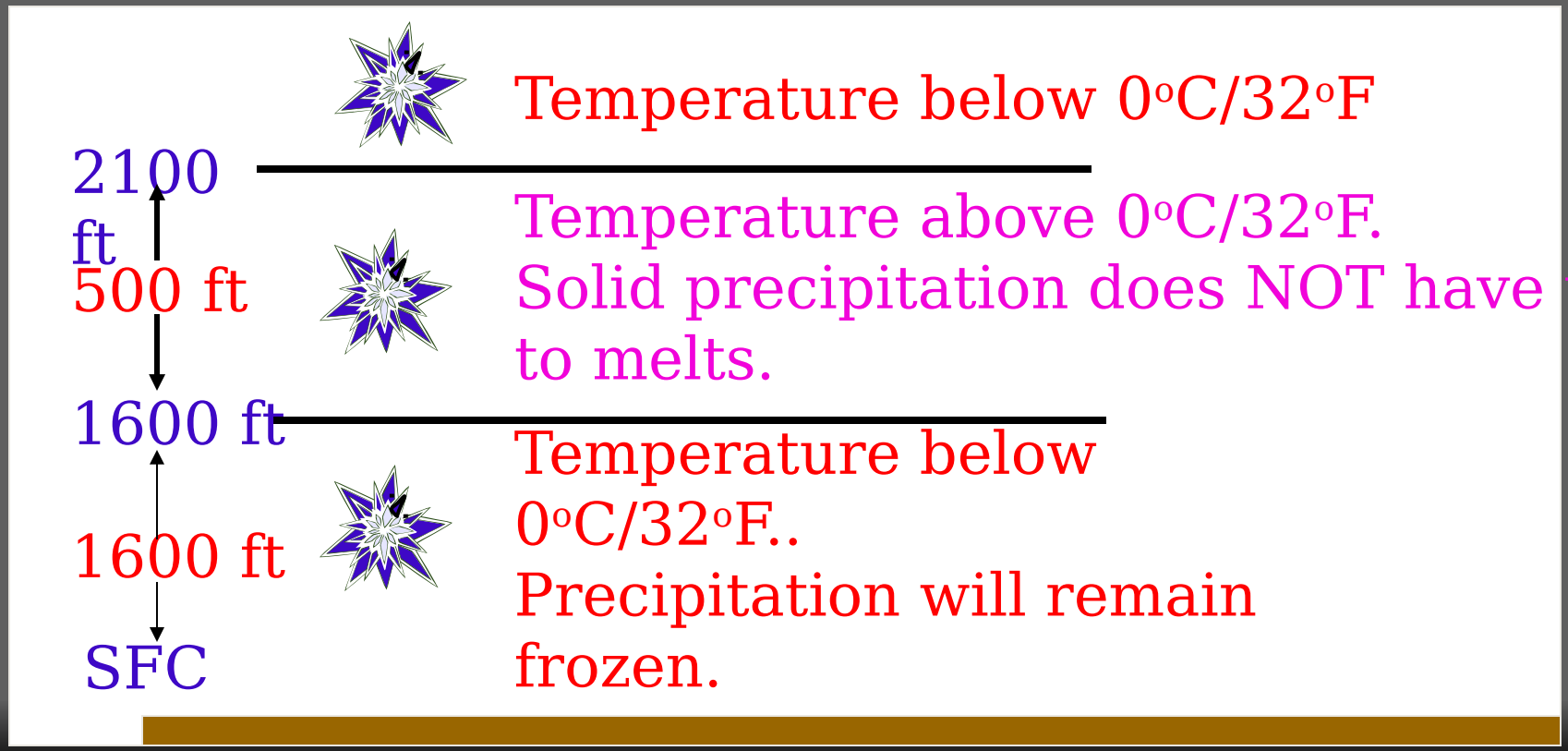
MULTIPLE FREEZING LEVELS

warm layer 600 – 1200 ft, cold layer > 1500 ft


Temperature below 0°C/32°F
2600 ft
1000 ft
Temperature above 0°C/32°F. Solid precipitation partially melts to super cooled water droplets. An ice core remains.
1600 ft
1600 ft
Temperature below 0°C/32°F. Droplets refreeze into ice pellets..
SFC

MULTIPLE FREEZING LEVELS

warm layer is < 600 ft, cold layer > 1500ft



MULTIPLE FREEZING LEVELS

- Whether complete melting will occur in a warm layer or not depends on many variables (e.g. crystal size, depth of the warm layer, temperature within the warm layer, etc).

MULTIPLE FREEZING LEVELS

- Most snowflakes melt completely with maximum temperatures in the warm layer between 1° and 4° C.

- If the maximum temperature in the warm layer is between these specified temperatures, forecast freezing rain. If colder forecast snow or ice pellets.

FREEZING PRECIPITATION TYPES

- Freezing Rain is rain that falls in liquid form but freezes upon impact to form a coating or glaze upon the ground and on exposed objects.
  - Objects above the ground such as cars, bridges and aircraft , may have surfaces below zero even if the ground is above zero.

FREEZING PRECIPITATION TYPES

- It is necessary that the liquid be super cooled before striking the ground for freezing rain.
- Freezing rain, when encountered by aircraft in flight, can cause dangerous accumulation of clear icing.

FREEZING PRECIPITATION TYPES

- Freezing Drizzle is drizzle that falls in liquid form but freezes upon impact to form a coating of glaze upon the ground and on exposed objects.
  - Objects above the ground such as cars, bridges and aircraft , may have surfaces below zero even if the ground is above zero.

FREEZING PRECIPITATION TYPES

- It is necessary that the liquid drops be super cooled before striking the ground.
- Freezing drizzle, when encountered by aircraft in flight, can cause dangerous accumulation of clear icing.

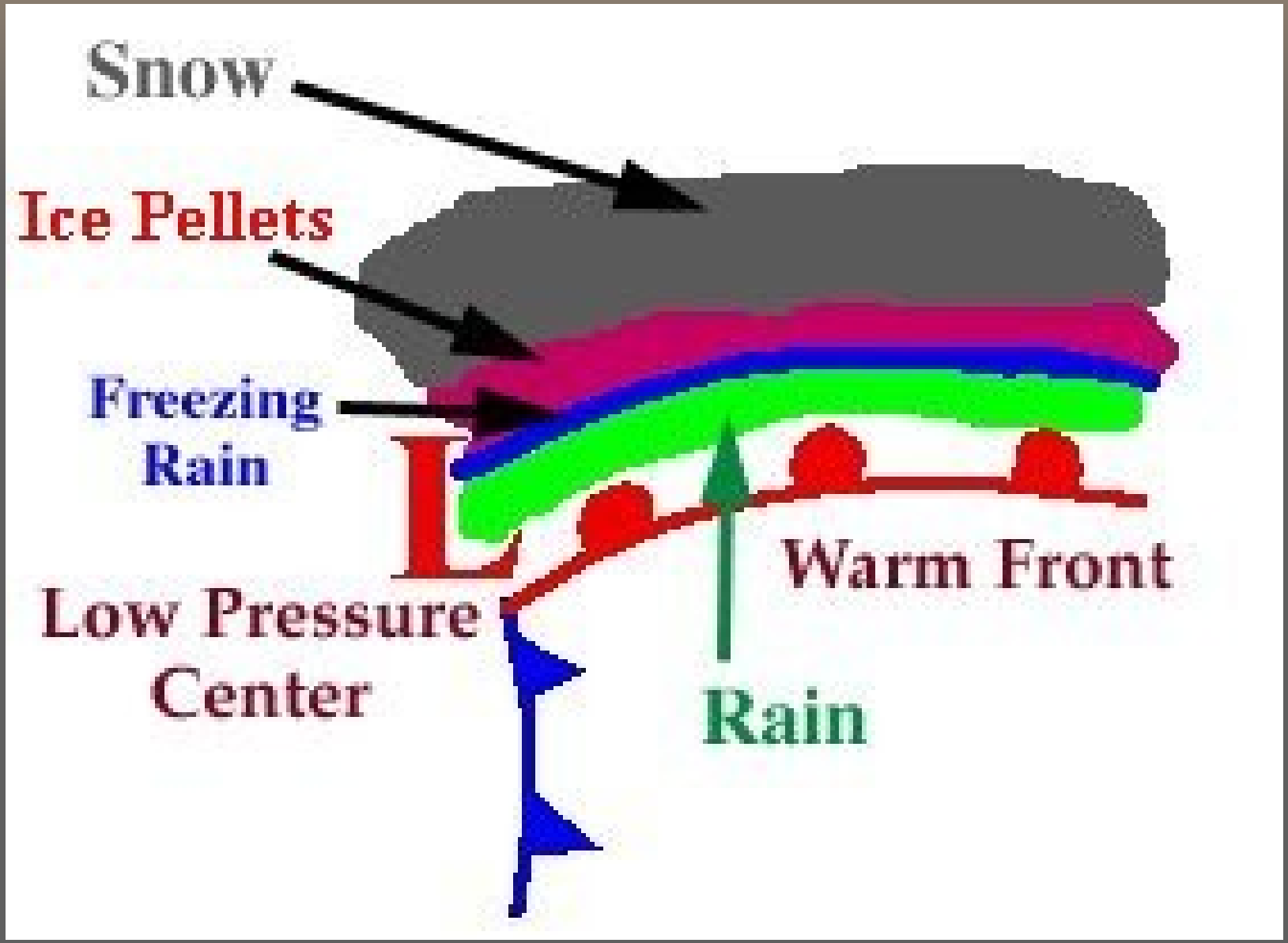
SYNOPTIC PATTERNS

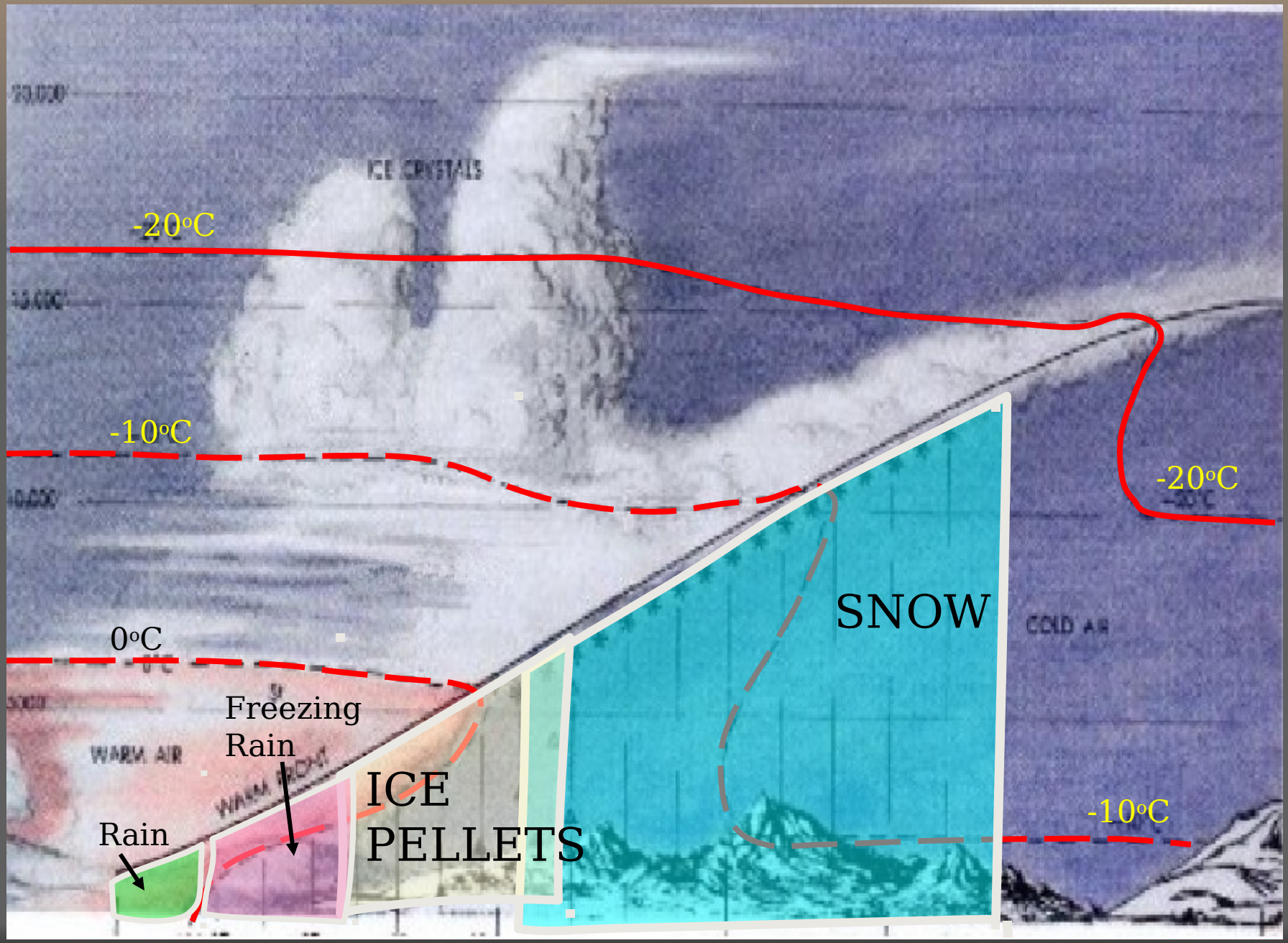
- There are several synoptic patterns that are conducive to freezing precipitation events.

- The basic conditions necessary are a shallow layer of sub-freezing air near the surface with warmer, moist air overriding it.

SYNOPTIC PATTERNS

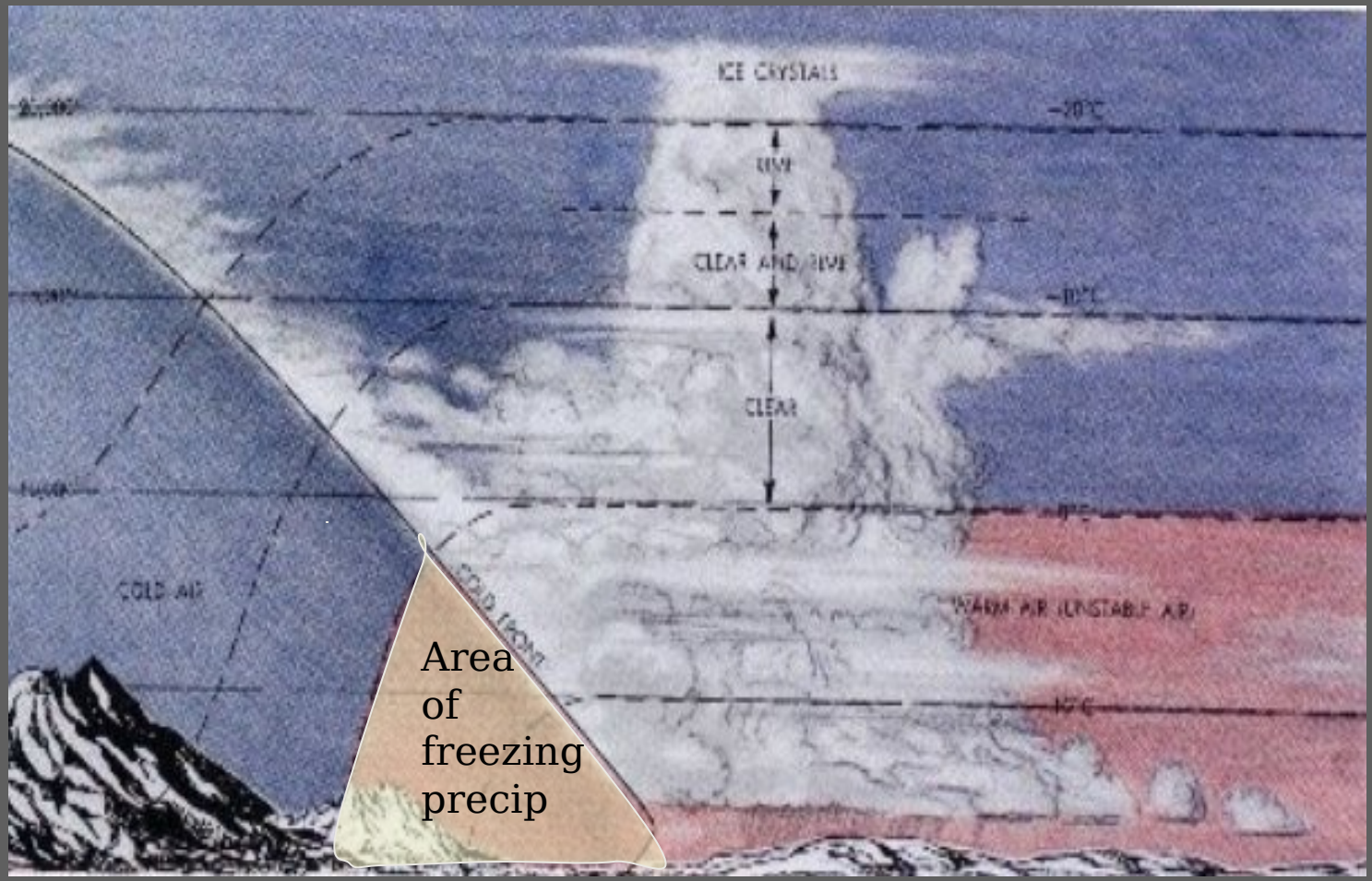
- FREEZING PRECIPITATION
  - A WARM FRONT is the MOST ideal situation for a freezing precipitation event.
    - It will produce the most widespread freezing precipitation episodes .
  - A STATIONARY FRONTAL BOUNDARY with moist air overrunning an arctic or polar airmass.


Snow
Ice Pellets
Freezing Rain
L
Warm Front
Low Pressure Center
Rain


ICE CRYSTALS
-20°C
-10°C
-20°C
0°C
SNOW
COLD AIR
WARM AIR
Freezing
Rain
ICE
PELLETS
Rain
-10°C

SYNOPTIC PATTERNS

- FREEZING PRECIPITATION
  - A COLD FRONT where the polar or arctic air wedges under the warmer moist air ahead of it.


ICE CRYSTALS
CLEAR
COLD AIR
Area
of
freezing
precip

SYNOPTIC PATTERNS

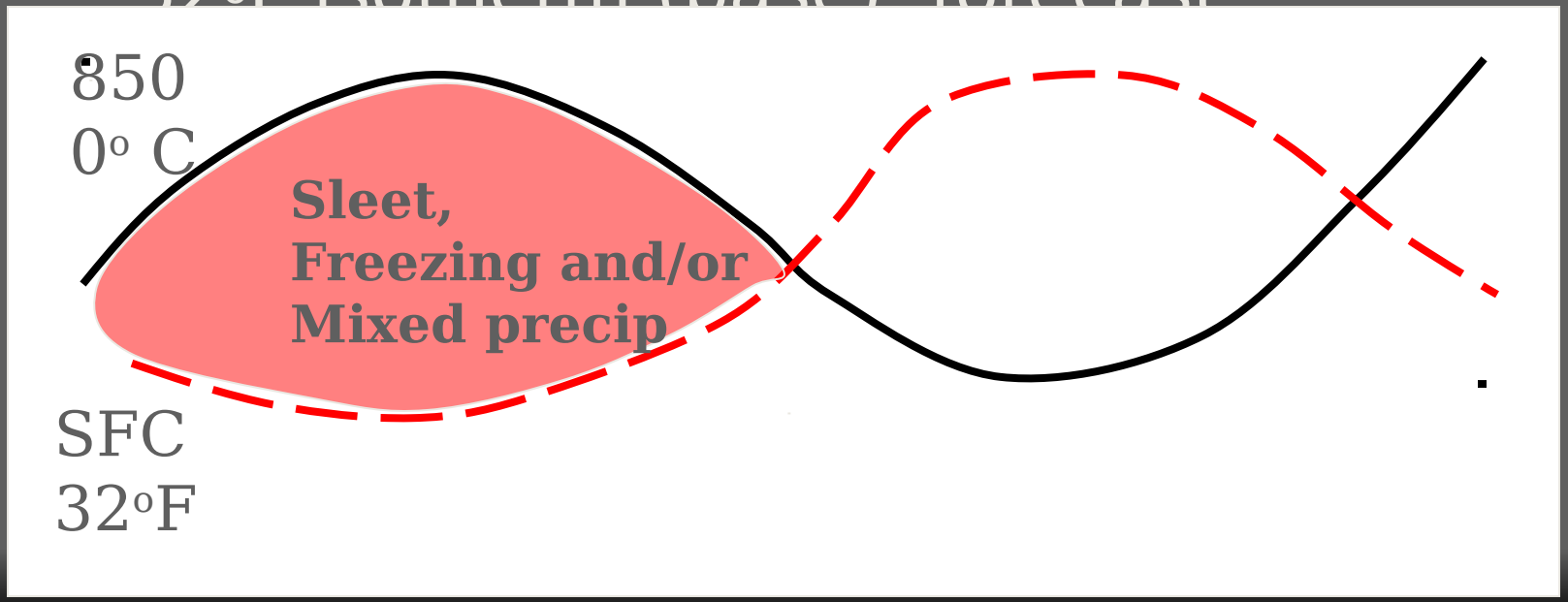
- ICE PELLETS
  - There must be a deep cold pocket near the surface and a warm pocket aloft 600 to 1200 ft thick.
  - As partially melted snow falls into the cold air, it totally refreezes into ice pellets.
  - Usually occurs in narrow bands between areas of freezing precipitation and snow.

METHOD OF FORECASTING FREEZING PRECIPITATION

- Surface and 850 mb Isotherm Pattern:
  - To initially determine precipitation type, the 850 mb 0◦ C and the 32◦F isotherms are good guidelines.
  - By using the 32◦F isotherm as a base, the placement of the 850 mb 0◦C, with respect to the base, is a good starting point

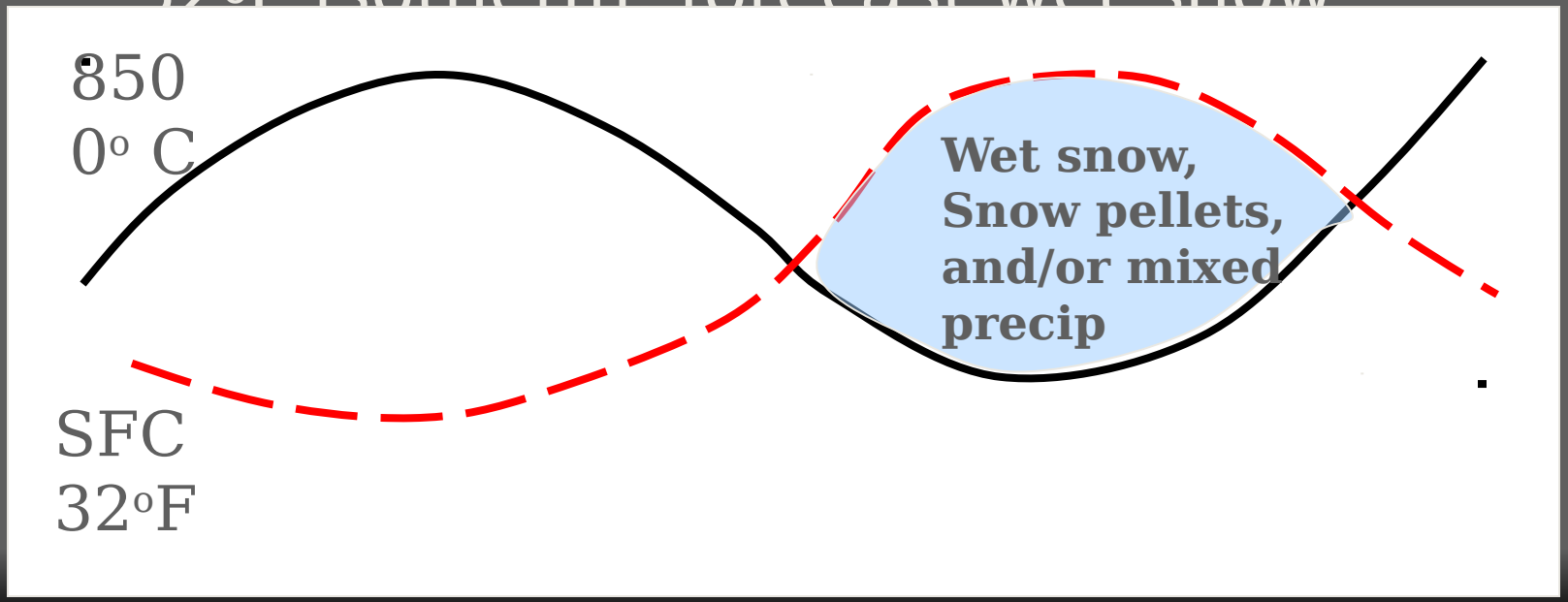
METHOD OF FORECASTING FREEZING PRECIPITATION

- Surface and 850 mb Isotherm Pattern:
  - When the 850 mb 0° C isotherm is on the cold (north) side of the surface 32°F isotherm (base), forecast



METHOD OF FORECASTING FREEZING PRECIPITATION

- Surface and 850 mb Isotherm Pattern:
  - When the 850 mb 0° C isotherm is on the warm (south) side of the surface 32°F isotherm, forecast wet snow



METHOD OF FORECASTING FREEZING PRECIPITATION

- Surface and 850 mb Isotherm Pattern:
  - East of the Appalachian mountains, use the 850 mb's 2° C isotherm instead of 0° C.

METHOD OF FORECASTING FREEZING PRECIPITATION

- Thickness
  - Isopleth analysis is a good tool for forecasting the types of precipitation during winter months.
  - 1000-500 mb thickness
    - Easiest chart to use
    - Delineates between liquid and solid precipitation
    - 5,400 meter isopleth is the **Threshold value** which delineates between liquid (on the warm side) and solid (on the cold side) precipitation.

METHOD OF FORECASTING FREEZING PRECIPITATION

- Thickness
  - 1000-500 mb thickness
    - The 5,400 mb thickness is most representative over the mid-west and northern plains.
    - Lower thickness value thresholds exist over mountains, higher threshold values near the coast.
    - Freezing Precipitation is forecast between the 5,400 and 5,520 meter thickness isopleths where surface temperatures are $\leq 32^{o}F$.

METHOD OF FORECASTING FREEZING PRECIPITATION

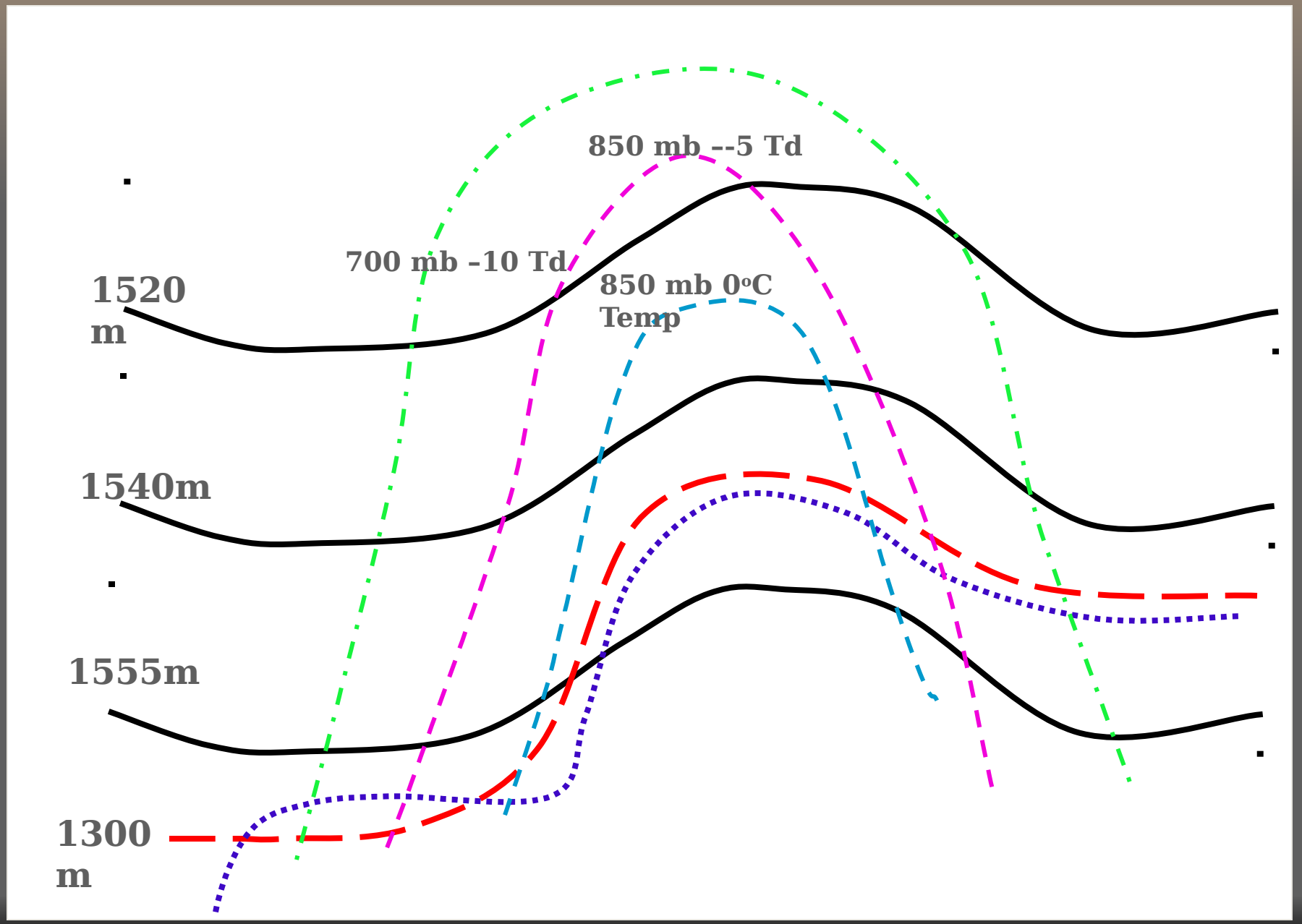
- Thickness
  - Low-level thickness (LLT) (1000-850 mb)
    - This chart is computed by subtracting the 1000 mb chart from the 850 mb chart.
  - Mid-level thickness (MLT) (850-700 mb)
    - Computed by subtracting the 850 mb height from the 700 mb height.
    - Determine the location of the following isopleths:1,520, 1,540, and 1,555.
    - The 1,555 isopleth is the threshold value for mid-level thickness.

METHOD OF FORECASTING FREEZING PRECIPITATION

- Thickness
  - The reason we want to find these values is that we can now make a composite chart to help perform an analysis for precipitation types based on thickness values (remember earlier we talked about the thickness of the warm and cold layers to help determine precipitation).

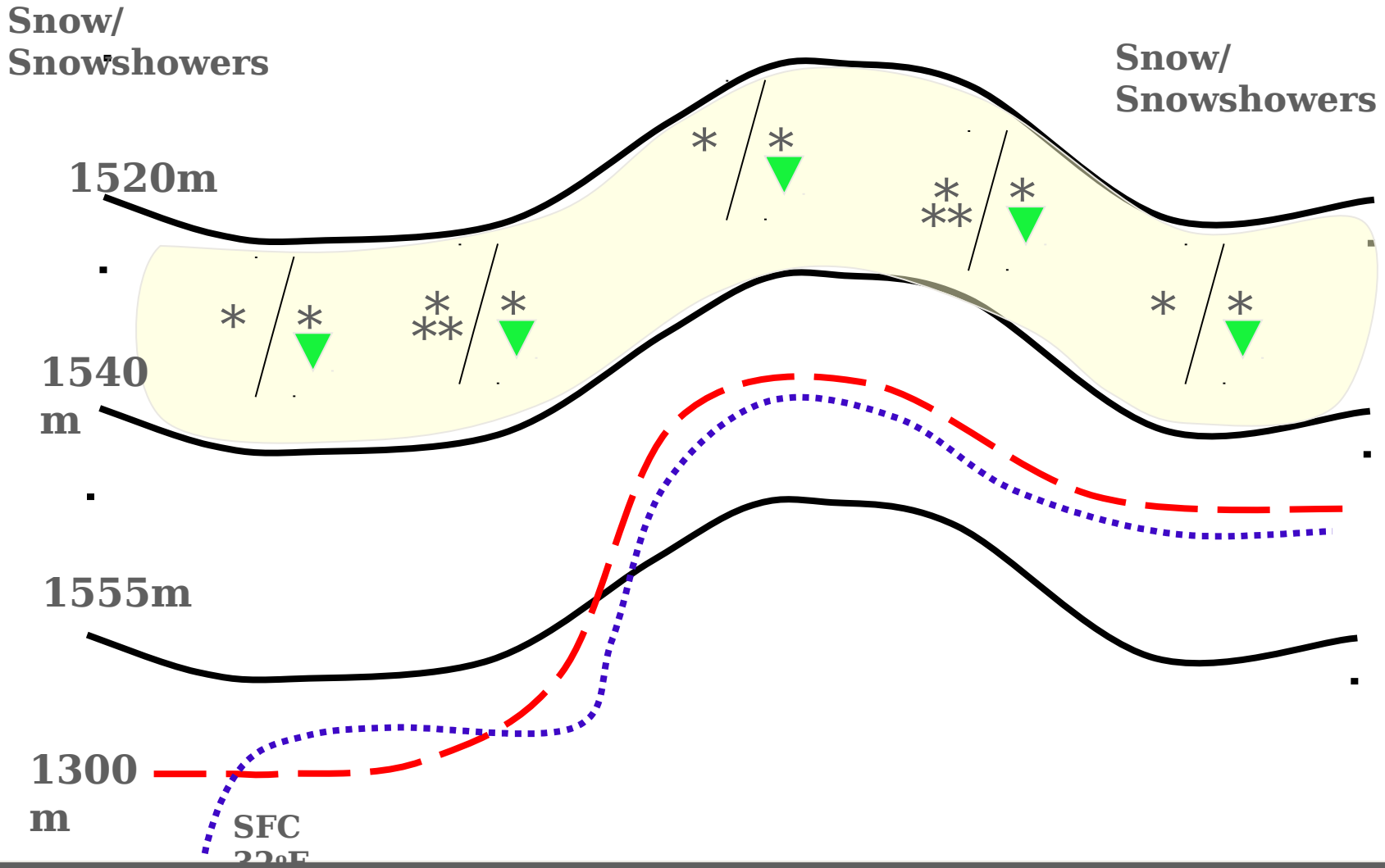
METHOD OF FORECASTING FREEZING PRECIPITATION

- Thickness
  - The following parameters will be analyzed for:
    - surface 32°F isotherm
    - 850 mb 0° C isotherm
    - 700 mb -5° C dewpoint temperature
    - 700 mb -10° C dewpoint temperature
    - 1,300 low-level thickness (LLT) isopleth
    - 1,520, 1,540, and 1,555 mid-level thickness (MLT) isopleths.


850 mb --5 Td
700 mb –10 Td
850 mb 0°C
Temp
1520
m
1540m
1555m
1300
m

METHOD OF FORECASTING FREEZING PRECIPITATION

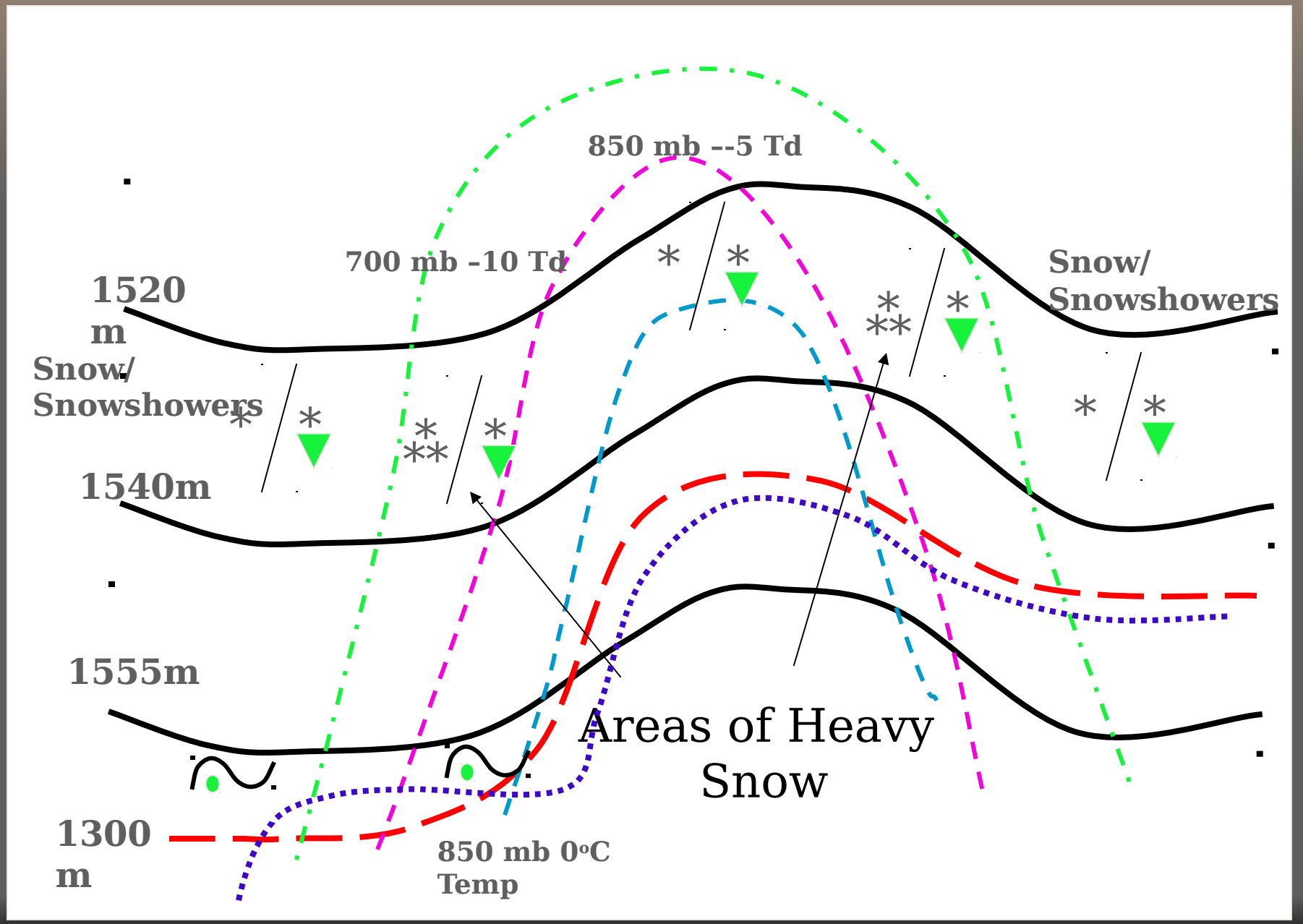
- Thickness
  - Chart Interpretation
    - Forecast snow or snow showers if you are between the 1,520 and 1,540 MLT isopleths and on the cold side of the 1,300 m LLT isopleth.


Snow/
Snowshowers
Snow/
Snowshowers
1520m
1540
m
1555m
1300
m
SFC
32°F

METHOD OF FORECASTING FREEZING PRECIPITATION

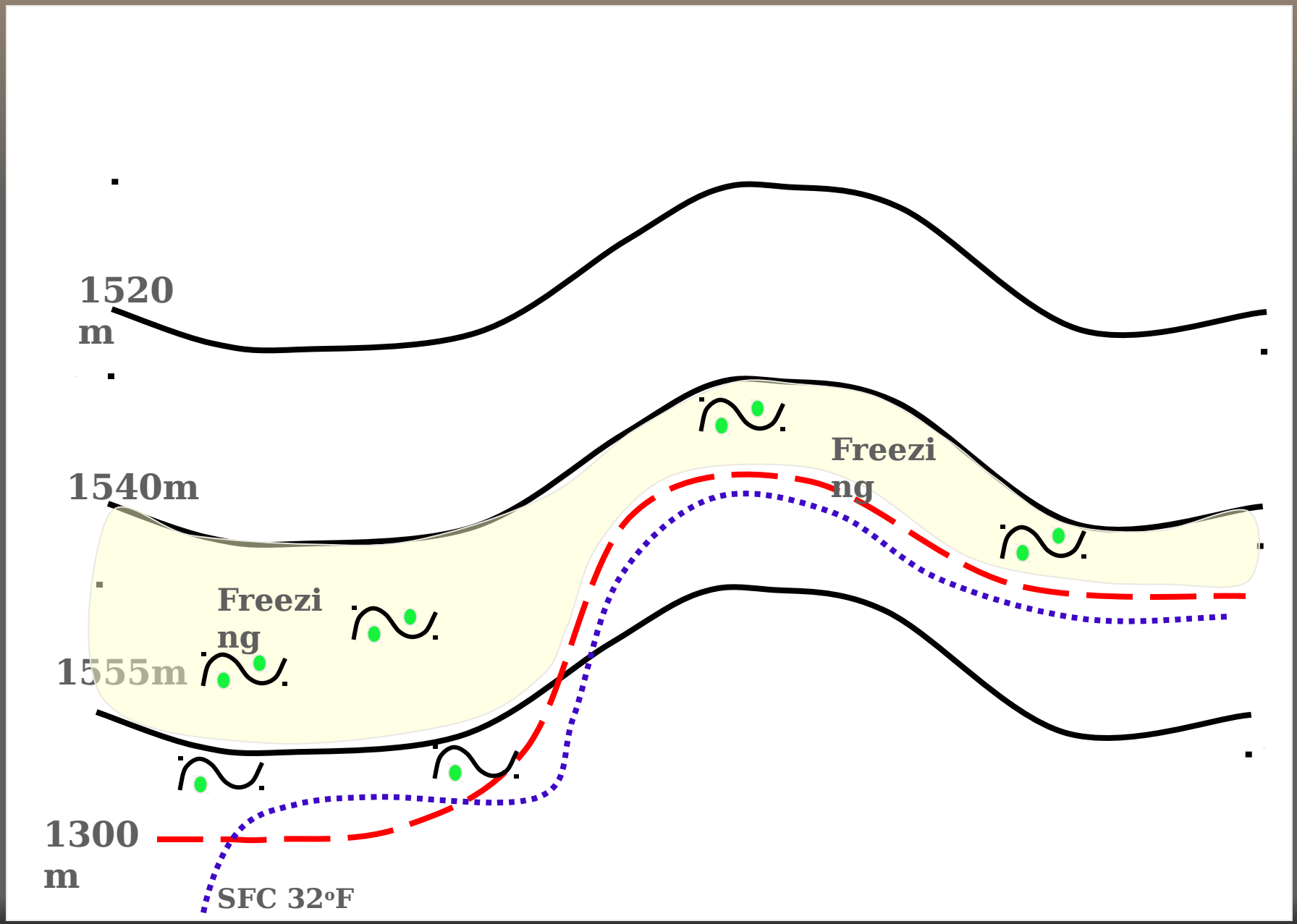
- Thickness
  - Chart Interpretation
    - Forecast heavy snow in the same area is between the 700 mb –10◦C and the 850 mb

      –5◦C dewpoint temperatures and on the cold side of the 850 mb 0◦C.


850 mb --5 Td
700 mb –10 Td
1520 m
Snow/ Snowshowers
Snow/ Snowshowers
1540m
1555m
1300 m
Areas of Heavy Snow
850 mb 0°C Temp

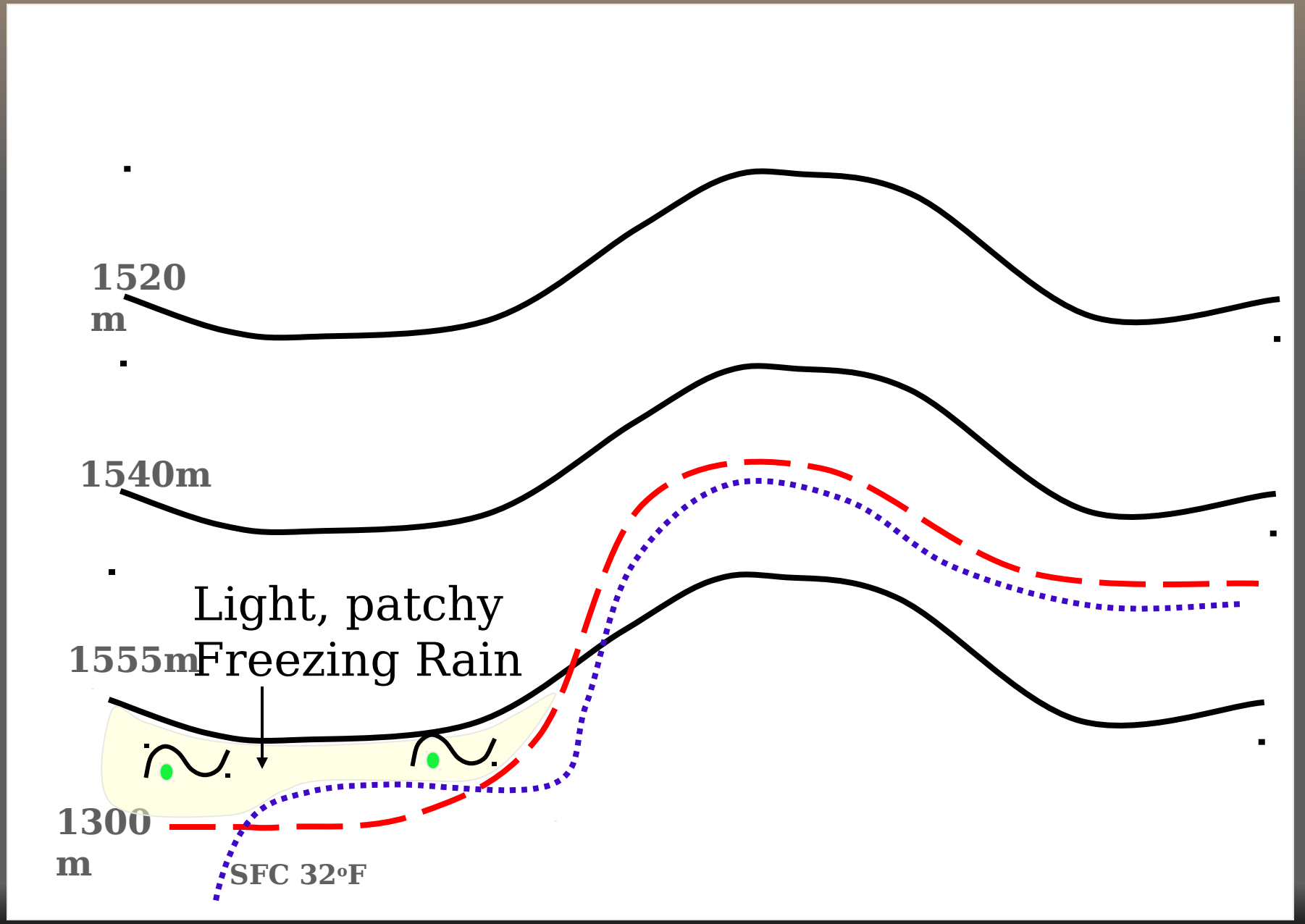
METHOD OF FORECASTING FREEZING PRECIPITATION

- Thickness
  - Chart Interpretation
    - Forecast freezing precipitation between the 1,540 and 1,555 m MLT isopleths, and on the cold side of the 1,300 m LLT isopleth.


1520 m
1540m
Freezing
Freezing
1555m
1300 m
SFC 32°F

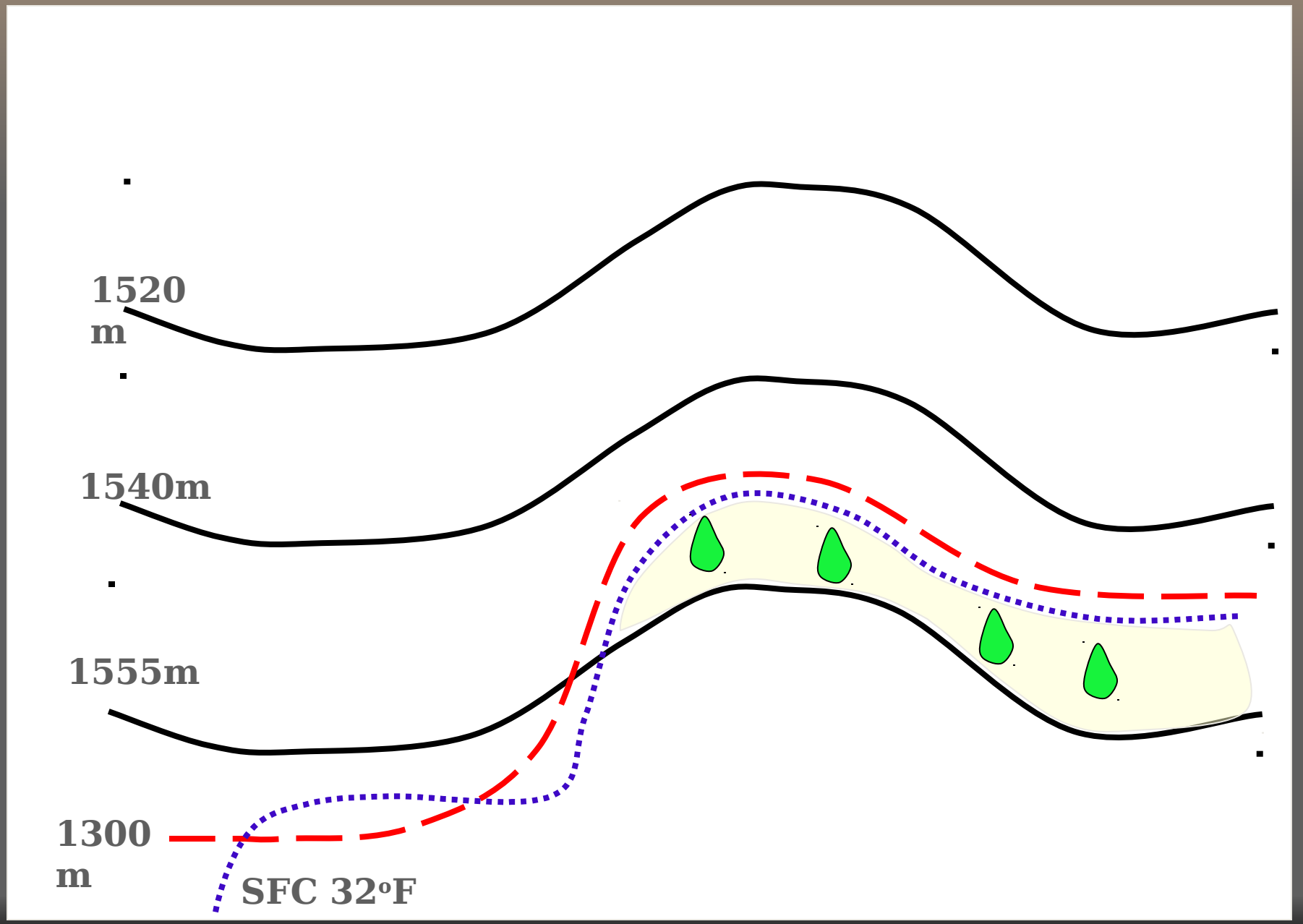
METHOD OF FORECASTING FREEZING PRECIPITATION

- Thickness
  - Chart Interpretation
    - Forecast light, patchy freezing precipitation on the warm side of the 1,555 m MLT isopleth but on the cold side of the 1,300 m LLT isopleth and surface 32°F isotherm.


1520 m
1540m
Light, patchy Freezing Rain
1555m
1300 m
SFC 32°F

METHOD OF FORECASTING FREEZING PRECIPITATION

- Thickness
  - Chart Interpretation
    - Forecast rain if any, in the area between 1,540 and 1,555 m MLT isopleths that lay on the warm side of the 1,300 m LLT isopleth.


1520 m
1540m
1555m
1300 m
SFC 32°F

METHOD OF FORECASTING FREEZING PRECIPITATION

- Thickness
  - Chart Interpretation
    - After analyzing for the various components you will want to move them along to see how it will affect your station.
      - Both the mid level and the low level isopleths can be moved using 100% of the 8,000 ft and 3,000 ft winds respectively.
      - The 850 and 700 mb isotherms and dewpoints will move with the short wave troughs at that level.

METHOD OF FORECASTING FREEZING PRECIPITATION

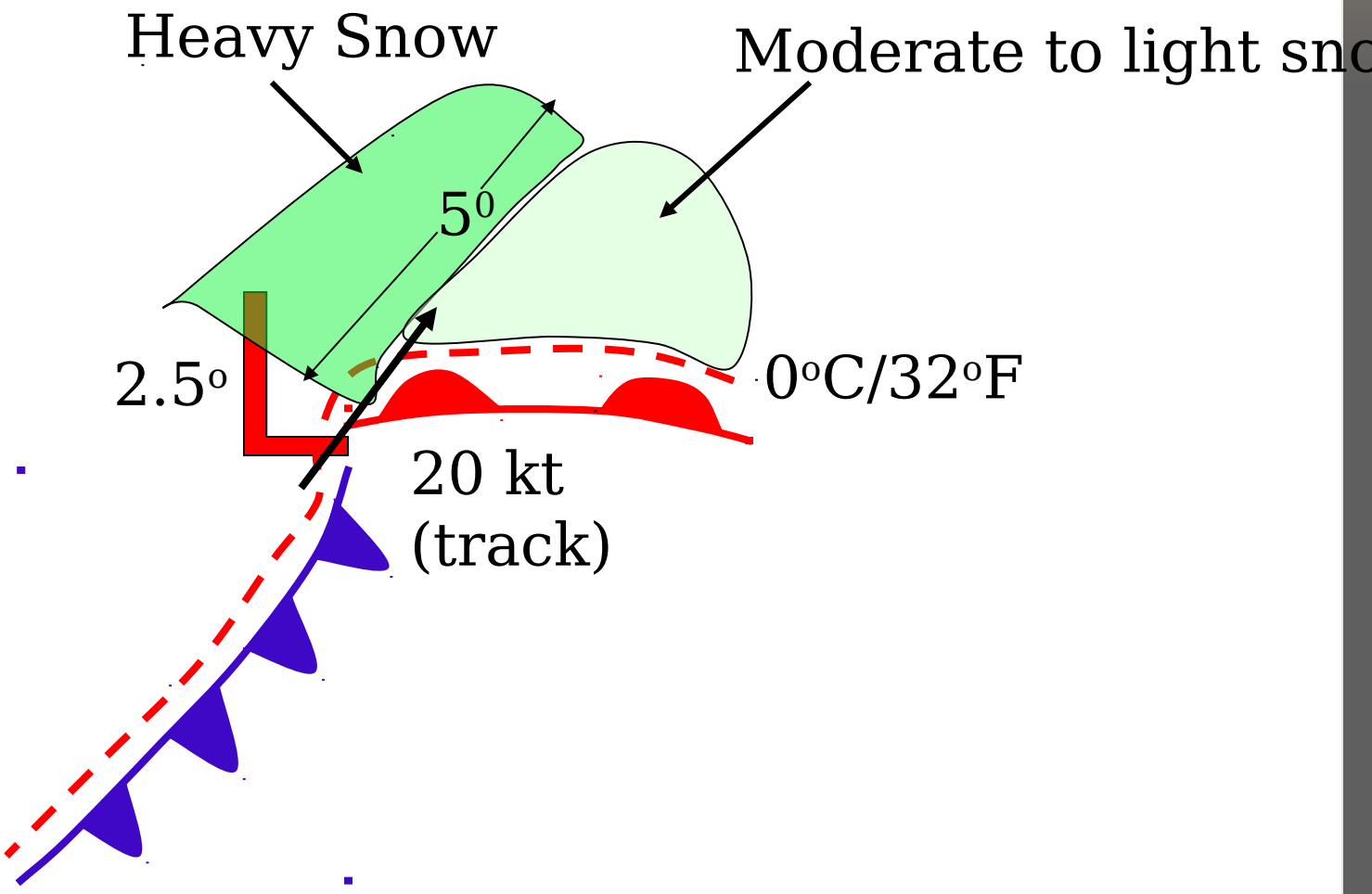
- Snow Index
  - This method uses the 1000 mb to 700 mb thickness to calculate between solid and liquid.
    - **y + 2x = 4179 meters**
      - **Where y = the 700 mb - 850 mb (MLT)**
      - **And x = 850 mb - 1000 mb (LLT)**

METHOD OF FORECASTING FREEZING PRECIPITATION

- Snow Index
  - If the answer is greater than 4,179 m – Liquid
  - If the answer is less than than 4,179 m – Solid
  - If the answer is equal to 4,179 m – Mixed

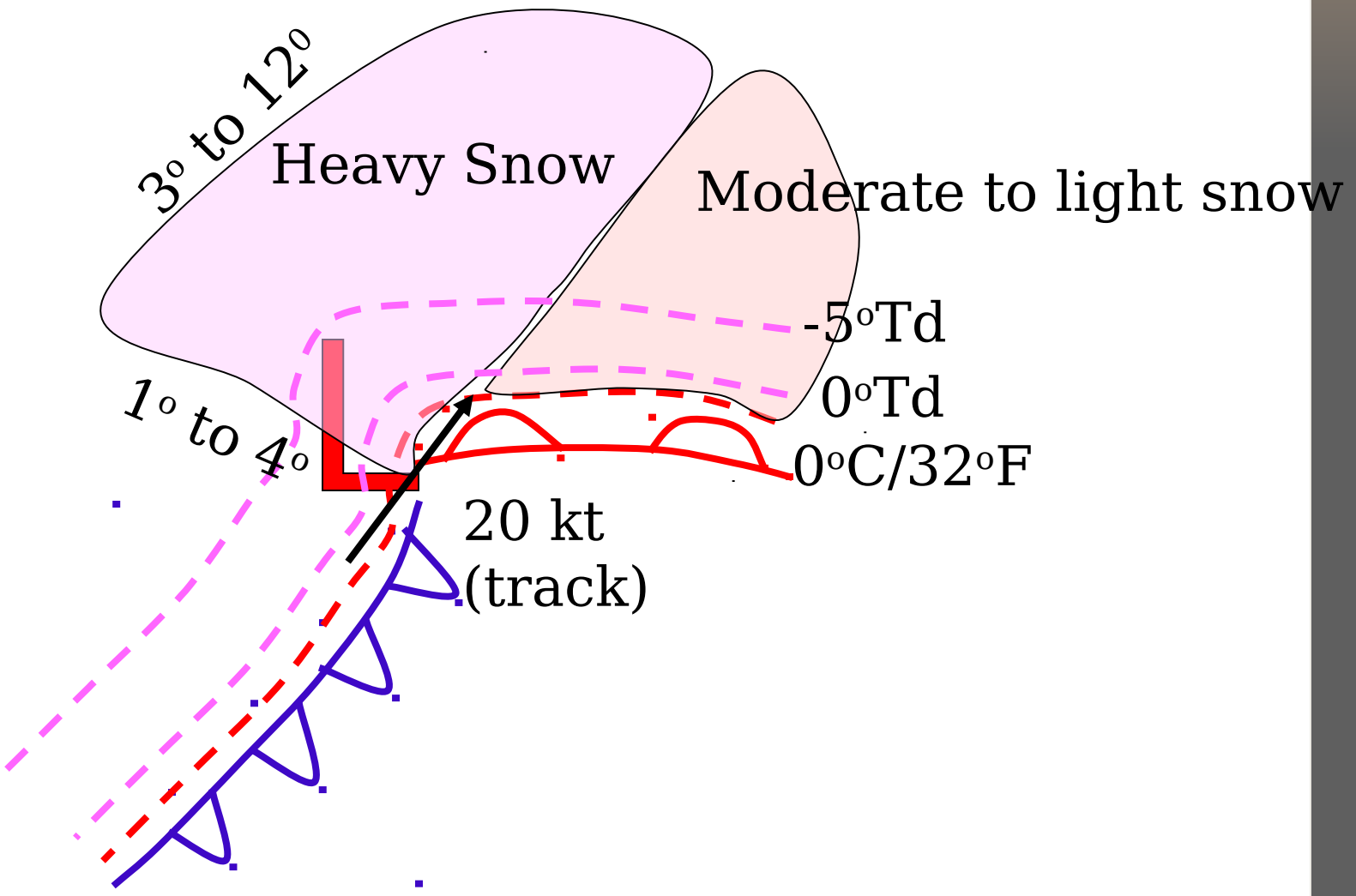
HEAVY SNOW

- Heavy snow is defined as the accumulation of $\geq$ 2 inches in a 12-hour period.
- Location of the heaviest snow in relation to:
  - Surface Analysis (Low pressure center)
    - On the cold side of the 0°C isotherm
    - Up to 2.5° latitude to the left of the track of the occluded and/or non-occluded low and up to 5° latitude downstream.


Heavy Snow
Moderate to light snc
5⁰
2.5°
0°C/32°F
20 kt
(track)

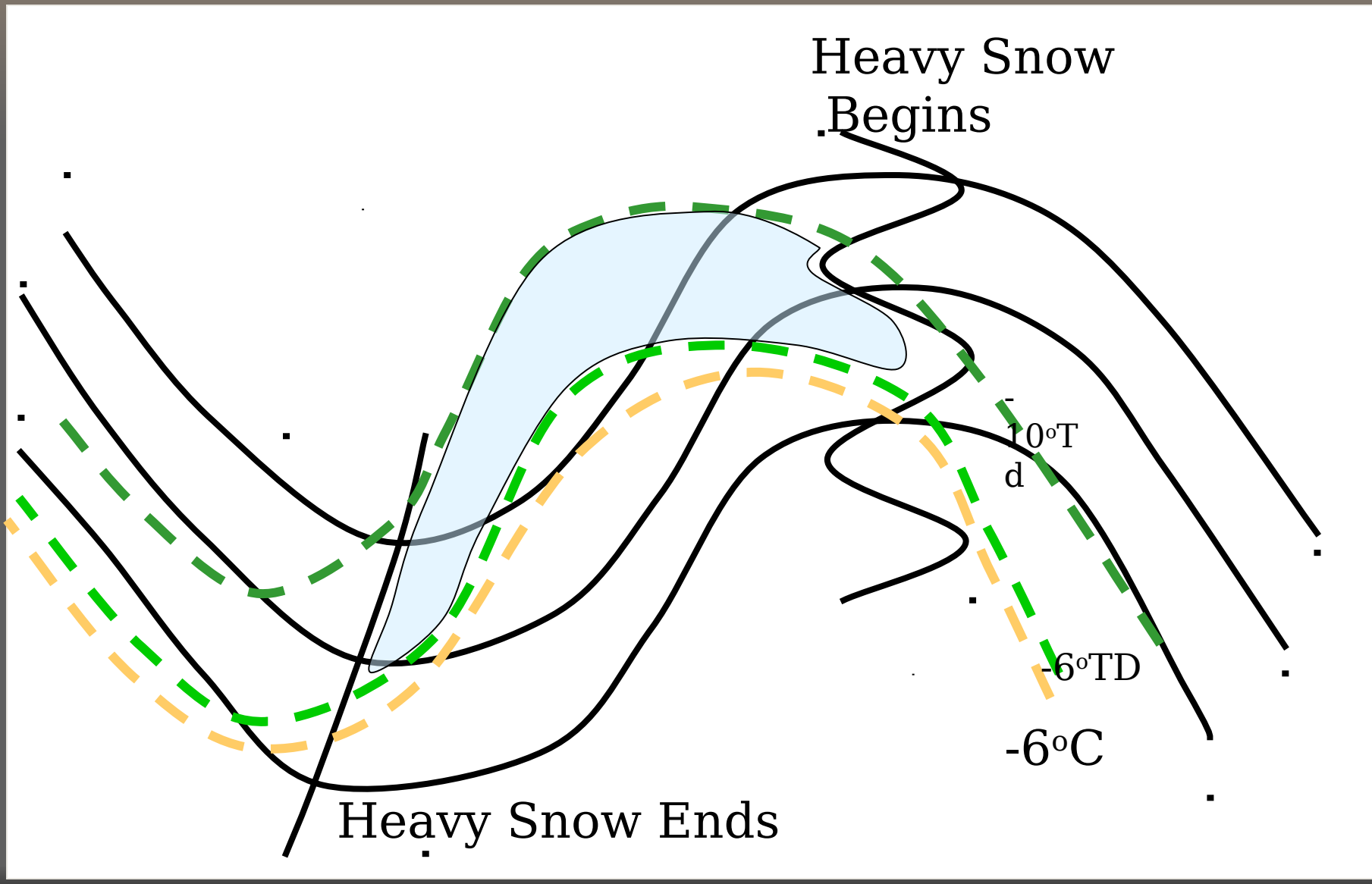
HEAVY SNOW

- Location of the heaviest snow in relation to:
  - 850mb analysis (low height center)
    - On the cold side of the 0°C isotherm (-2°C on the east coast) where the dew points are between 0° and –5°C.
    - Anywhere from 1° to 4° latitude to the left of the track, from 3° to 12° latitude downstream of the low.
    - The 850 mb –5°C isotherm often bisects the area of heaviest snow in the following 12-hr period.


3° to 12°
Heavy Snow
Moderate to light snow
-5°Td
0°Td
0°C/32°F
1° to 4°
20 kt
(track)

HEAVY SNOW

- Location of the heaviest snow in relation to:
  - 700 mb analysis (low height center/trough)
    - On the cold side of the –6°C isotherm where the dew points are between –6° and –10° C
    - Along the track of the 700 mb low
    - Snow usually begins with the passage of the 700 mb ridge ahead of the low/trough
    - Heavy snow usually ends with passage of the 700 mb trough or low center

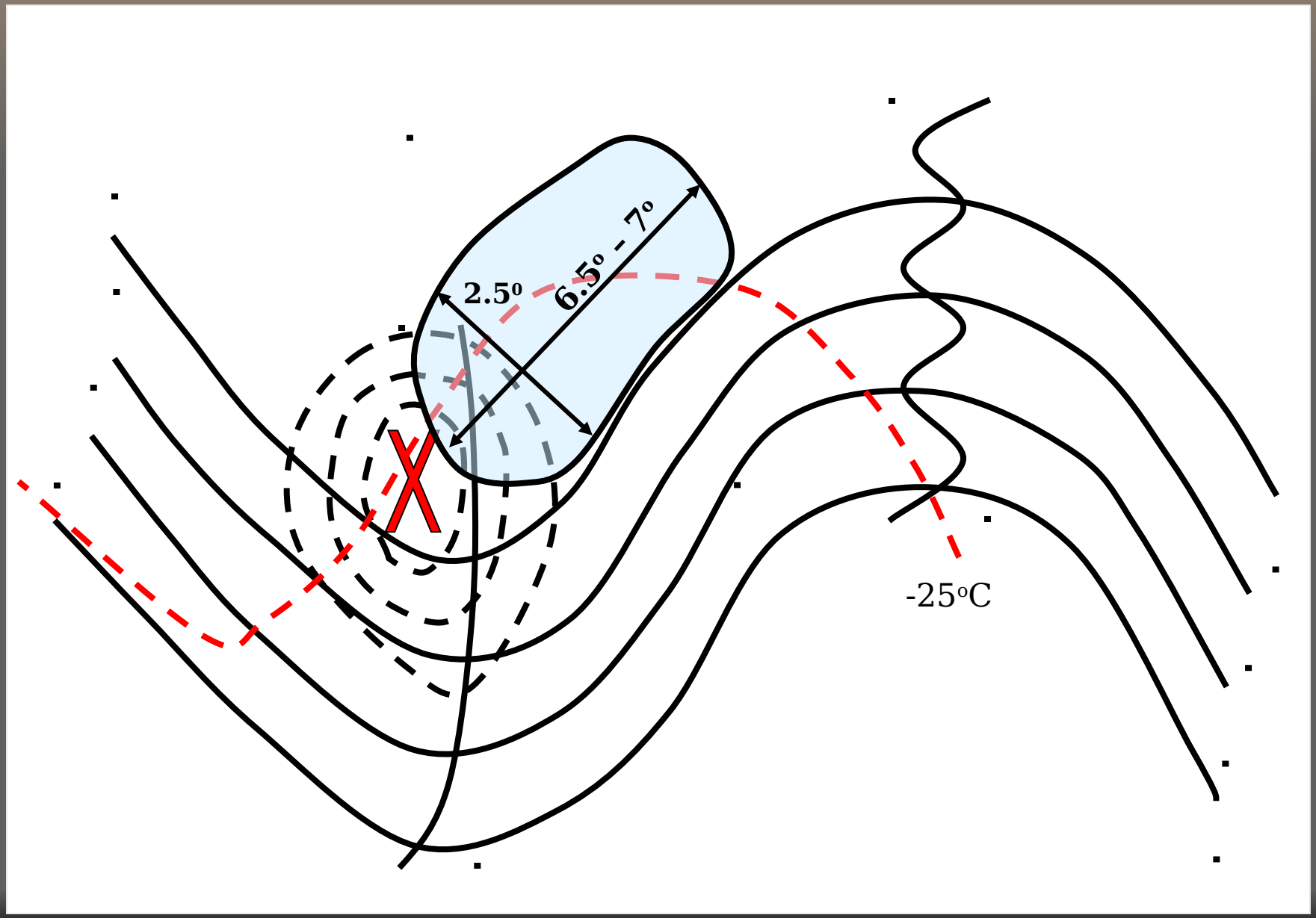

Heavy Snow
Begins
-10°T
d
-6°TD
-6°C
Heavy Snow Ends

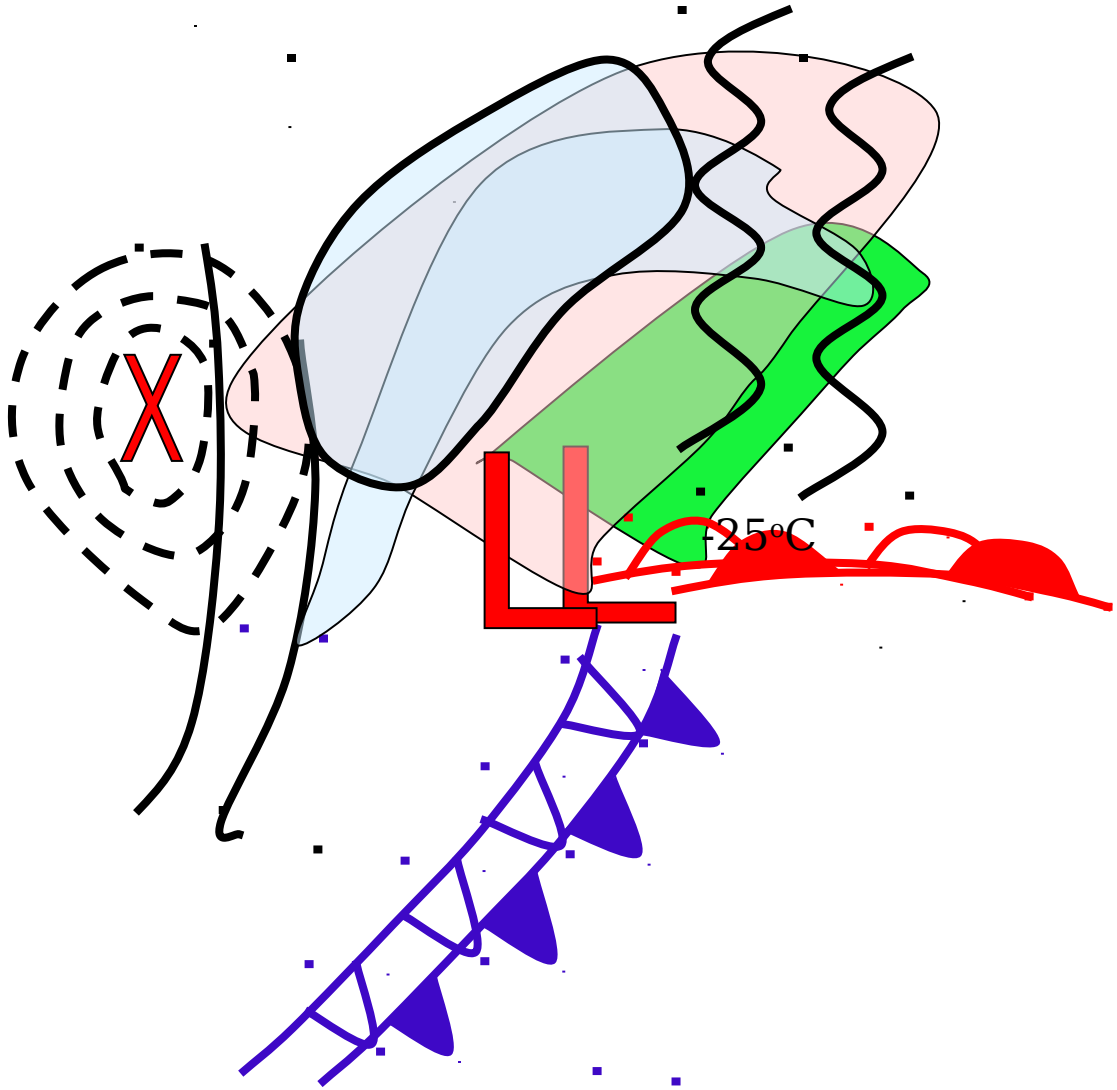
HEAVY SNOW

- Location of the heaviest snow in relation to:
  - 500 mb analysis (low height center/trough)
    - On the cold side of the –35°C isotherm if located north of 40° North
    - On the cold side of the –25°C isotherm if located south of 40° North
    - Along the track of the 500 mb low
    - Up to 2.5° latitude to the left of the track of the 500 mb vorticity maximum and up to 6.5° to 7° latitude downstream

HEAVY SNOW

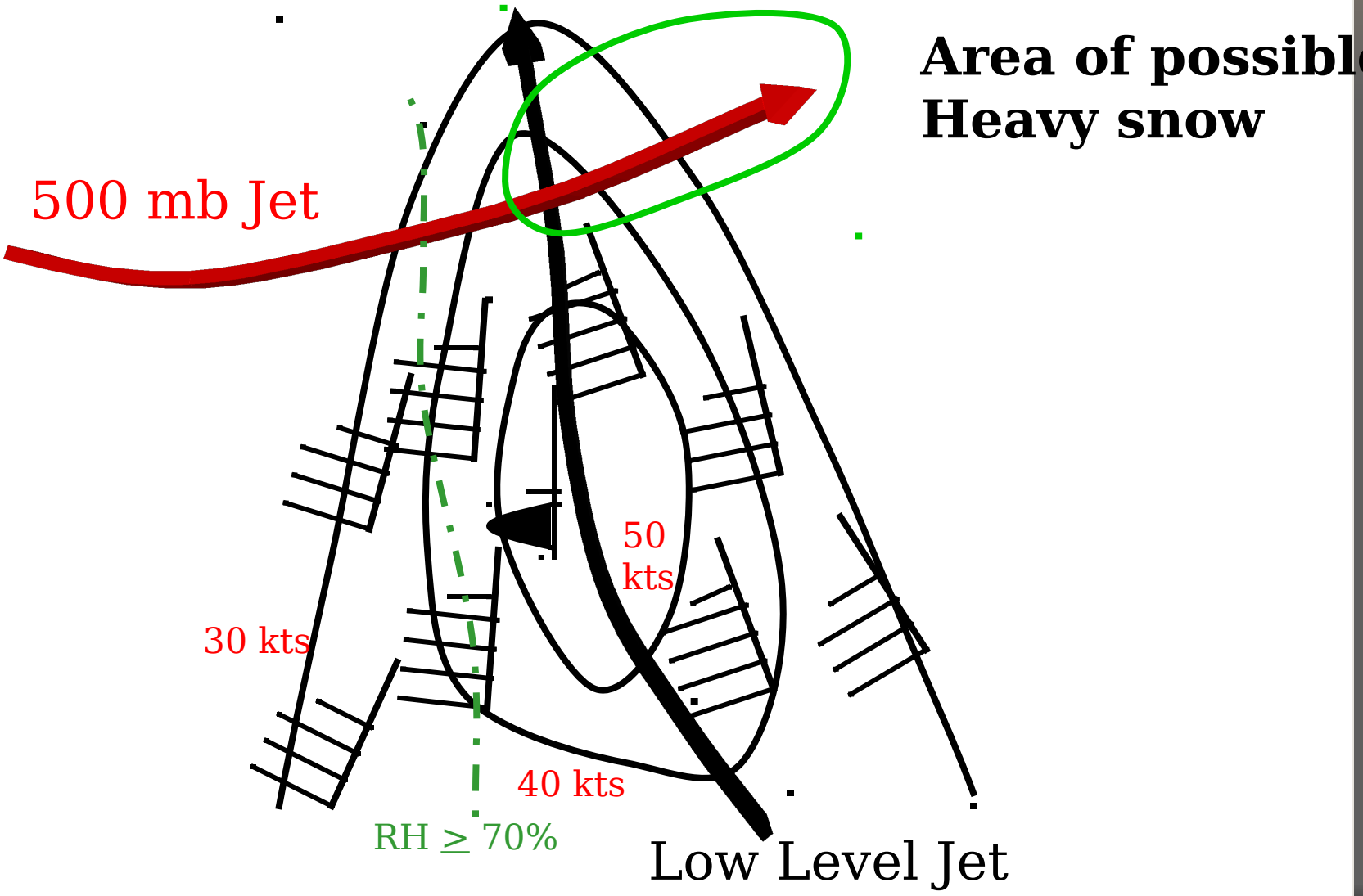
- Location of the heaviest snow in relation to:
  - 500 mb analysis (low height center/trough)
    - To the left of the track of the 500 mb height fall center and slightly downstream from the inflection point between the trough and downstream ridge.
    - Snow usually ends with the passage of the 500 mb trough, vorticity maximum or low center.


2.5°
6.5° - 7°
X
-25°C


X
L
+25°C

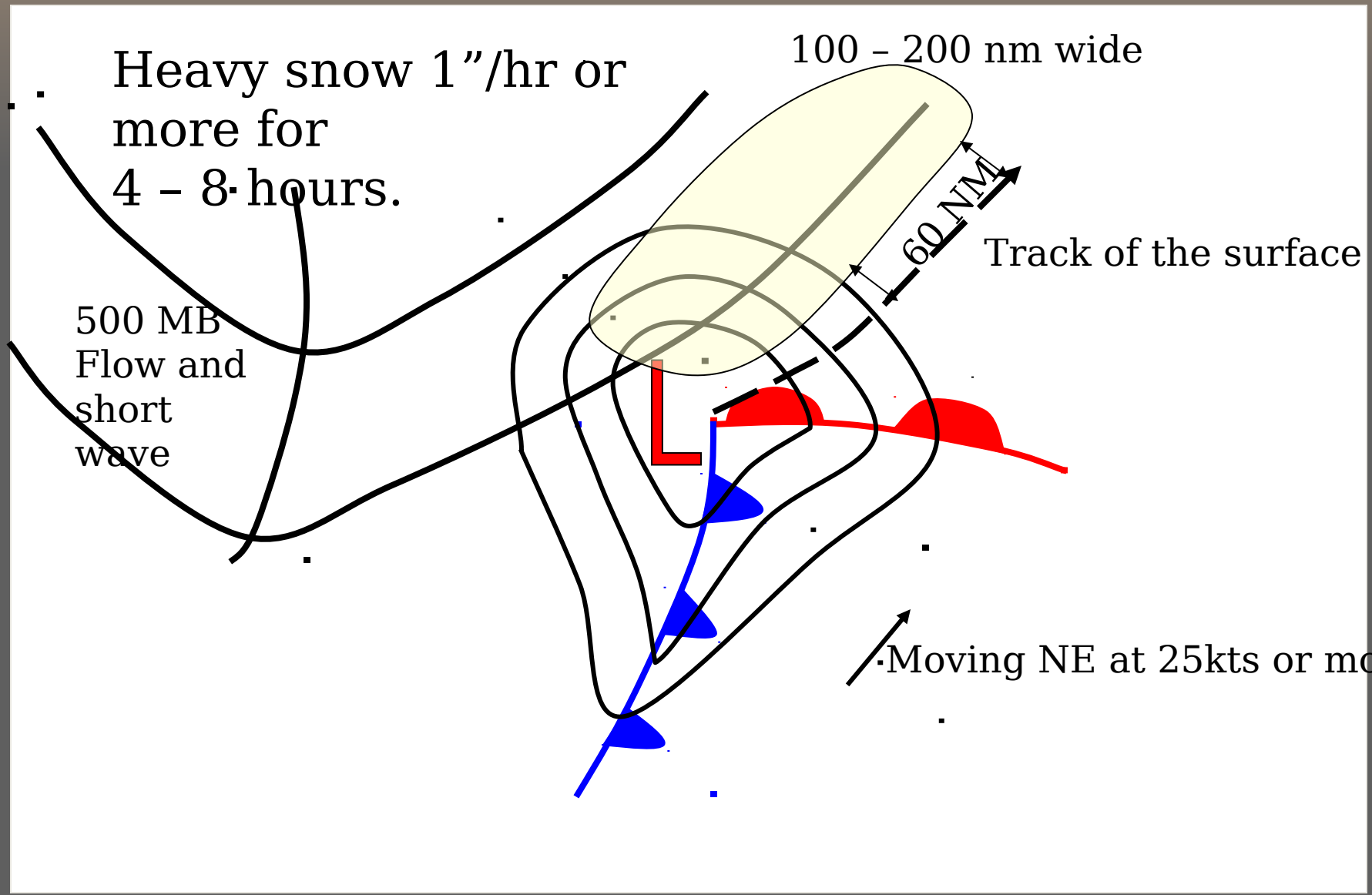
HEAVY SNOW

- Location of the heaviest snow in relation to:
  - Average Humidity/Maximum wind analysis
    - The area where the surface to 500 mb average relative humidity $\geq$ 70%
    - The area where the 850 mb and 500 mb maximum wind bands intersect
  - 1000/500 mb Thickness – Heavy snow usually occurs along the thickness ridge between the 5,310 and 5,370 meter thickness lines.


Area of possible
Heavy snow
500 mb Jet
50
kts
30 kts
40 kts
RH ≥ 70%
Low Level Jet

HEAVY SNOW SYNOPTIC SITUATIONS

- Baroclinic Non-occluding Low
  - This system usually tracks to the east-northeast at approximately ≥ 25 kts.
  - Usually associated with a fast moving trough at 500 mb


Heavy snow 1”/hr or more for 4 – 8 hours.
100 – 200 nm wide
60 NM
Track of the surface lo
500 MB Flow and short wave
L
Moving NE at 25kts or more

HEAVY SNOW SYNOPTIC SITUATIONS

- Baroclinic Non-occluding Low
  - Area of maximum snowfall
    - Lies left of the surface low oriented parallel to the track of the low
    - The southern edge of the max snowfall is located about 60 nm (1° latitude) to the left of the storm track
    - The width of the snow band is about 100 – 200 nm
    - The snowfall rate: ≥ 1 inch/hour lasting 4 to 8 hours

HEAVY SNOW SYNOPTIC SITUATIONS

- Baroclinic Deep-occluding Low (Blizzard type)
  - The most dangerous type of winter storm, associated weather includes:
    - Winds $\geq$ 30 kts, temperatures $\leq$ 20^{o}F
    - Visibilities reduced to <1/4 mile by blowing and/or falling snow
    - A severe blizzard contains winds $\geq$ 50 kts and temperatures $\leq$ 10^{o} F

HEAVY SNOW SYNOPTIC SITUATIONS

- Baroclinic Deep-occluding Low (Blizzard type)
  - This system features a deep occluding low with a downstream wraparound ridge that is oriented NW – SE (Type B occlusion)
  - Associated with a cold core low at 500 mb
  - This system usually tracks north – northeast, slowing to approximately 5 to 10 kts

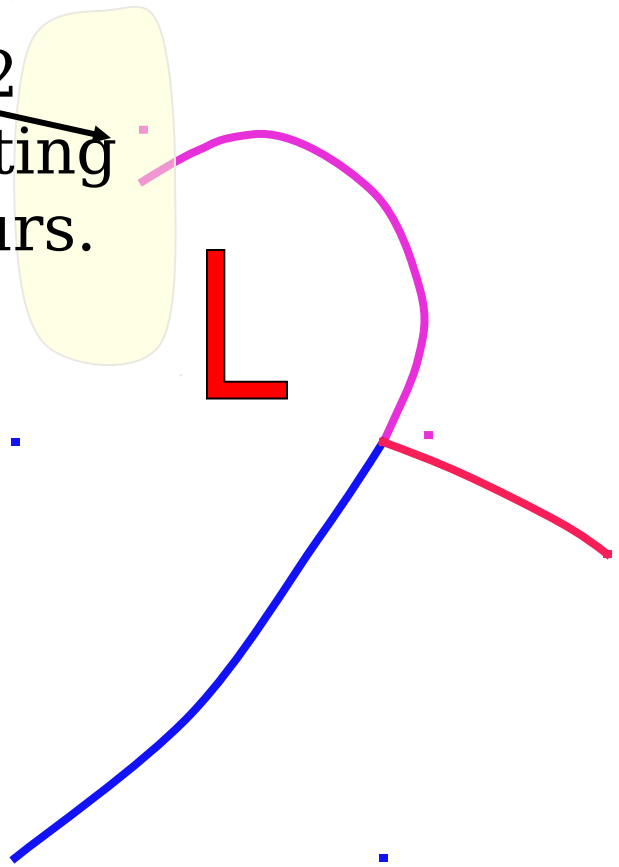
HEAVY SNOW SYNOPTIC SITUATIONS

- Baroclinic Deep-occluding Low (Blizzard type)
  - The area of maximum snowfall:
    - Lies to the left and parallel to the track of the surface low
    - Snowfall rates of 1 to 2 inches/hour lasting up to 10 hours, with the duration variable
    - The western edge of the heavy snow area is the 700 mb low and/or trough axis, with most of the snow usually ending with the passage of the 500 mb trough

HEAVY SNOW SYNOPTIC SITUATIONS

- Baroclinic Deep-occluding Low (Blizzard type)
  - The area of maximum snowfall:
    - If short waves continue to develop and propagate around the upper-level low, this system becomes highly susceptible to secondary development, especially along the east coast of continents.

Area of heavy snow fall – 1 to2 Inches/hour lasting for up to 10 hours.



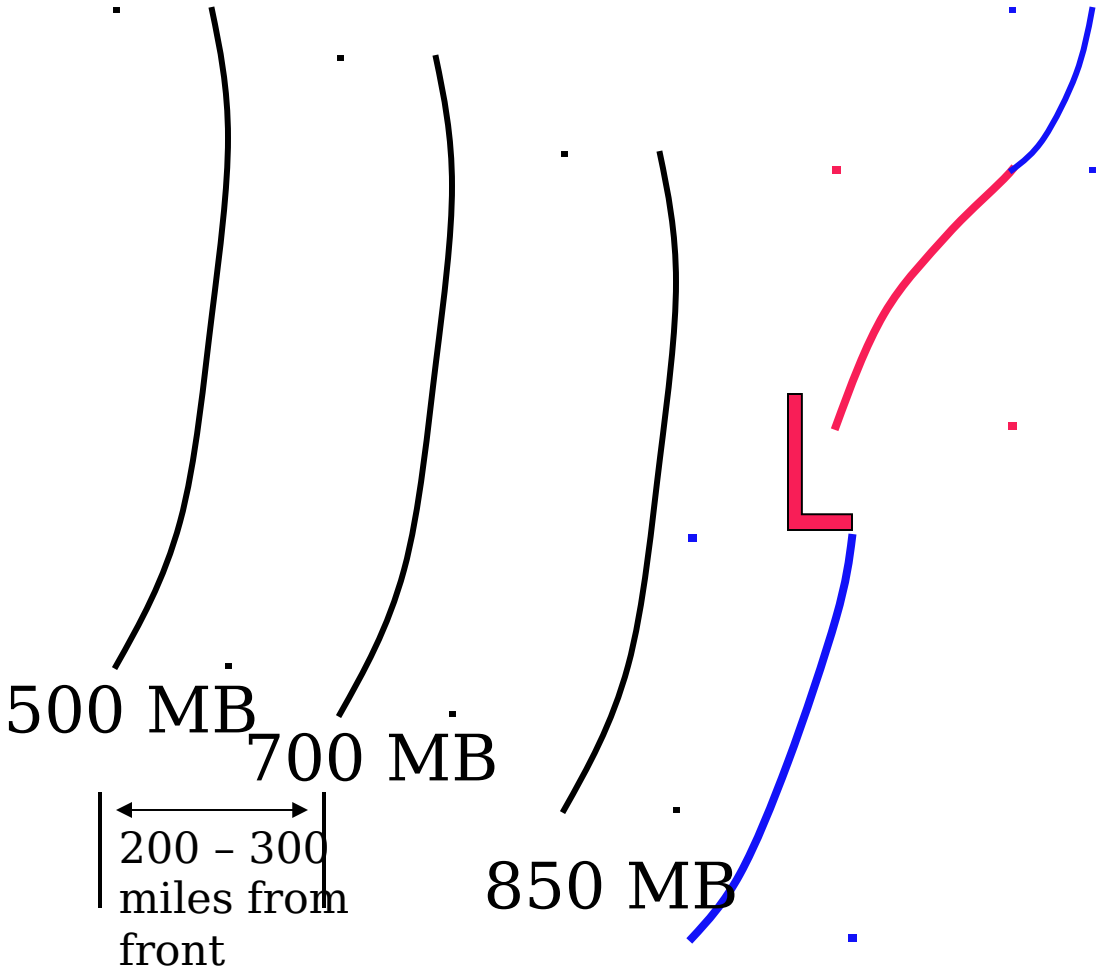
Track of the Surface low moving at 5 – 10 knots.

HEAVY SNOW SYNOPTIC SITUATIONS

- Post Cold Frontal Trough
  - Associated with a steep cold front oriented in a deep long wave trough
  - Minor wave forms on the front and moves northward along the front
  - Strong cold air advection from the surface to 850 mb exists to the west of the front

HEAVY SNOW SYNOPTIC SITUATIONS

- Post Cold Frontal Trough
  - Sharp amplitude short-wave troughs at 700 and 500 mb lie about 200 to 300 miles to the west of the surface front
  - Area of maximum snowfall:
    - Located between the 850 and 700 mb short wave troughs
    - The area is usually generated and then dissipates in 12 to 18 hours with heavy snow lasting only 2 to 4 hours.

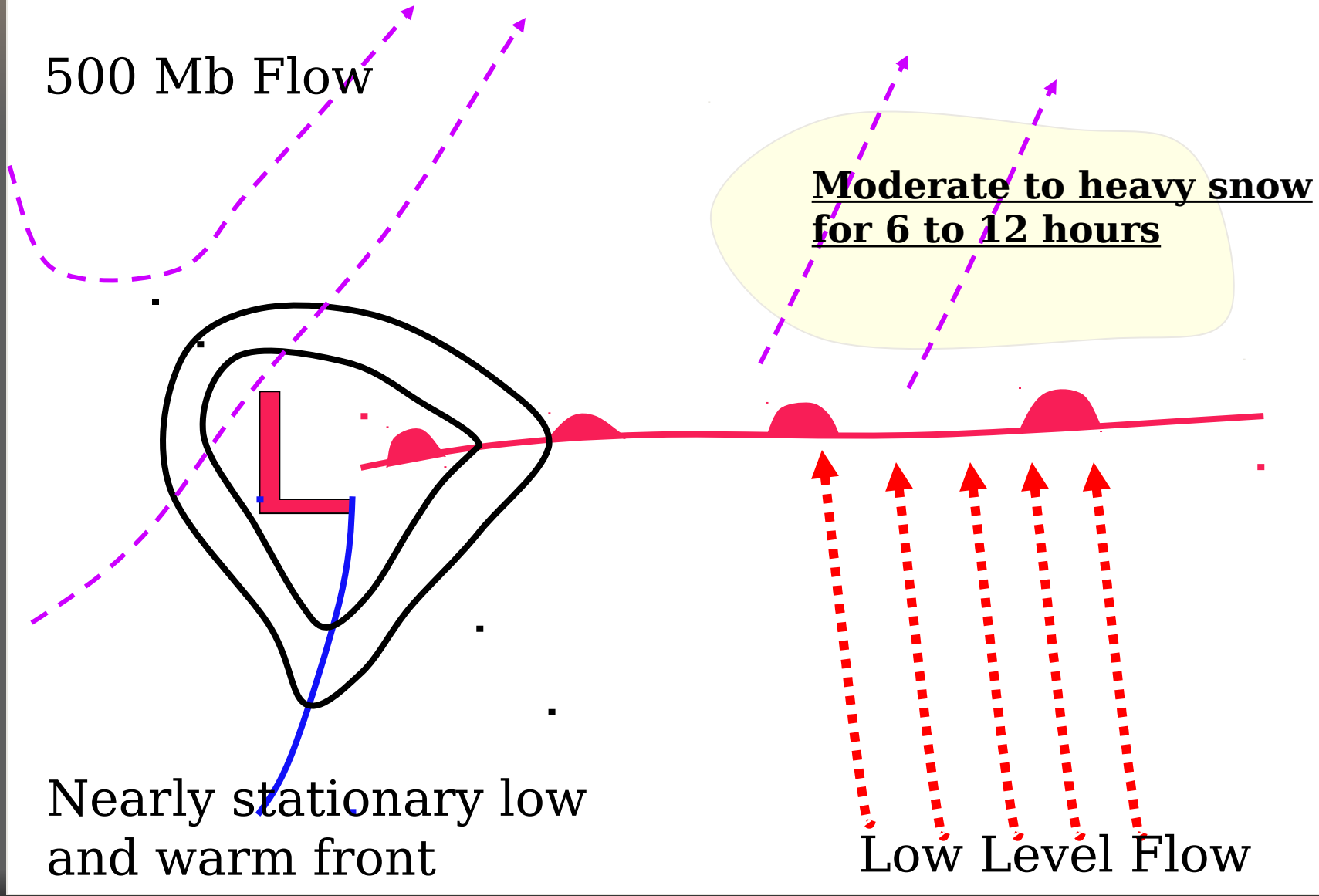

500 MB
700 MB
850 MB
200 – 300
miles from
front

HEAVY SNOW SYNOPTIC SITUATIONS

- Warm Advection
  - There is no active low pressure center in the vicinity of the maximum snow area.
  - A persistent high pressure ridge is situated to the north-northeast of a quasi-stationary front.
  - A well developed low-level flow at 850 mb of moist air is overrunning the frontal surface.

HEAVY SNOW SYNOPTIC SITUATIONS

- Warm Advection
  - Area of maximum snowfall:
    - Located in a band parallel to and just north of the quasi-stationary surface front.
    - Moderate to heavy snow usually lasting 6 –12 hours.
    - If the warm front begins to move, expect a change from snow to freezing rain and then to rain due to advection of warmer, low level air.

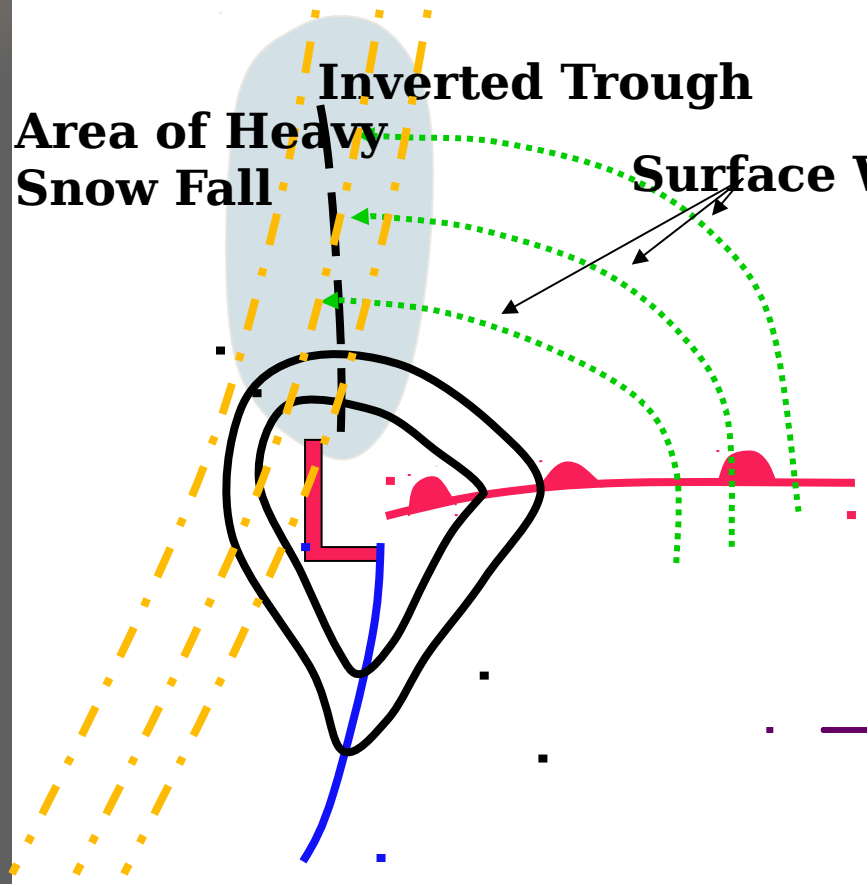

500 Mb Flow
Moderate to heavy snow
for 6 to 12 hours
L
Nearly stationary low
and warm front
Low Level Flow

HEAVY SNOW SYNOPTIC SITUATIONS

- Inverted Trough
  - An inverted trough will extend northward from a closed low pressure system.
  - Easterly component of low level flow produces overrunning of the inverted trough as well as an upslope condition.
  - All snowfall usually ends with the passage of the 700 mb trough.

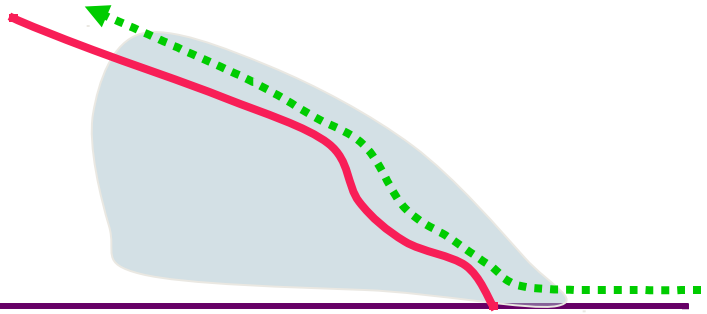
HEAVY SNOW SYNOPTIC SITUATIONS

- Inverted Trough
  - Heavy snow is produced when the 500 mb flow is parallel to the surface inverted trough.
  - Area of maximum snowfall:
    - Located within and on either side of the inverted surface trough.
    - Amounts depend on the moisture supply, winds and speed of movement of the trough.



500 mb Wind Flow

As the warm air is lifted
the trough, it condenses
and the moisture falls as
snow



Side View of Inverted Troug

200 MB SNOW INDEX

- This heavy snow technique is used to forecast the maximum snowfall amount and the area.
- It uses the warm air sink associated with a well-developed baroclinic low.

200 MB SNOW INDEX

- Procedure
  - Forecasting snowfall amount – an index for the average snowfall (in inches) for the following 24 hours.
    - Determine the 200 mb temperature at your station.
    - Find the 200 mb warm pocket that is located between 6° and 14° latitude upstream of your station.

200 MB SNOW INDEX

- Procedure
  - Determine the amount of warm air advection that is occurring between the warm pocket and your station.
  - Take ½ of this indicated temperature change (ΔT) to determine the amount of snowfall (Note: If the WAA is < 6° latitude upstream, snowfall will be of short duration).

200 MB SNOW INDEX

- Procedure
  - Example:
    - Temperature in the warm pocket = -45°C
    - Temperature over your station = -55°C
    - ΔT = 10° of WAA
    - Snowfall – ½ X 10 = 5 inches in 24 hours.

200 MB SNOW INDEX

- Forecasting snowfall area:
  - The area of maximum snow will be near the coldest 200 mb temperatures downstream from the 200 mb warm pocket (sink).
  - This area will be parallel to the 200 mb contours, with the width being the same as the distance between adjacent contours.

200 MB SNOW INDEX

- Forecasting snowfall area:
  - The southwestern end of the maximum snow area is the warm sink and the northeastern end being the eastern edge of the cold pocket (dome).

200 MB SNOW INDEX

- Forecasting snowfall area:
  - To forecast where the point of maximum snowfall will be, use the following guidelines:
    - For a 24 hour forecast, look 14° latitude downstream from the 200 mb warm sink.
    - For a 36 hour forecast look 21° latitude downstream from the 200 mb warm sink. (Note: If there is no well defined warm pocket, use the 500 mb vorticity maximum.)

200 MB SNOW INDEX

- Weaknesses:
  - Do not forecast heavy snow beneath strong confluence at 200 mb. The heavy snow area will be to the south of this area.
  - **Do NOT forecast heavy snow SOUTH of the surface low.**

200 MB SNOW INDEX

- Weaknesses:
  - With a northeasterly flow aloft, systems will move rapidly and generally <2 inches of snow will fall.
  - 700 mb warm air advection into the threat area is essential; if cold air advection occurs into the threat area, forecast snow amounts of ¼ the individual warm air advection at 200 mb.

SUMMARY

- The type of precipitation will depend on the temperature, moisture, stability, and the cloud types.

- You must also take into account the height of the freezing level and depth of the warm layer.

SUMMARY

- SINGLE FREEZING LEVEL
- If the freezing level closest to the surface is:
  - ≥ 1200 ft AGL - **liquid (rain)**
  - ≤ 600 ft AGL - **solid (snow)**
  - 600 ft - 1200 ft AGL - **mixed (rain/snow)**

SUMMARY

- MULTIPLE FREEZING LEVELS
- If the warm layer is:
  - > 1200 ft thick – **Freezing Rain**
  - < 600 ft thick – **Snow**
  - 600 to 1200 ft thick – **Ice Pellets**

SUMMARY

- If the cold layer closest to the surface is > 1500 ft, forecast **freezing rain**.

- If the cold layer closest to the surface is ≤ 1500 ft, forecast **ice pellets**.

SUMMARY

- If the warm layer is > 1200 ft and the cold layer is ≤ 1500 ft, forecast **freezing rain.**
- If the warm layer is between 600 and 1200, ft and the cold layer is > 1500 ft, forecast **ice pellets.**
- If the warm layer is < 600 ft and the cold layer > 1500 ft, forecast **snow.**

SUMMARY

- There are several synoptic patterns that are conducive to a freezing rain event:
  - **WARM FRONT**
  - **STATIONARY BOUNDARY**
  - **COLD FRONT**

SUMMARY

- When the 850 mb 0^{o}C isotherm is on the cold (north) side of the surface 32^{o}F isotherm (base), forecast freezing precipitation or ice pellets.

- When the 850 mb 0^{o}C isotherm is on the warm (south) side of the surface 32^{o}F isotherm, forecast wet snow and/or mixed precipitation.

SUMMARY

- When using the thickness chart, the 5,400 isopleth is the THRESHOLD VALUE.
  - On the north side of the 5,400 line, forecast **SNOW**
  - On the south side of the 5,400 line, forecast **RAIN**.

SUMMARY

- There are several methods to determining the type of precipitation to forecast.
- The method you use will depend on the area you are forecasting for and the amount of time to prepare.

SUMMARY

- Heavy snow is defined as the accumulation of ≥ 2 inches in a 12-hours period.
- Surface Analysis
  - Up to 2.5° latitude to the left of the track of the occluded and/or non-occluded low and up to 5° latitude downstream.
- 850mb analysis
  - Anywhere from 1° to 4° latitude to the left of the track, from 3° to 12° latitude downstream of the low.

SUMMARY

- 700 mb analysis
  - Along the track of the 700 mb low.
  - Snow usually begins with the passage of the 700 mb ridge ahead of the low/trough.
  - Heavy snow usually ends with passage of the 700 mb trough or low center.
- 500 mb analysis
  - Up to 2.5° latitude to the left of the track of the 500 mb vorticity maximum and up to 6.5° to 7° latitude downstream.
  - Snow usually ends with the passage of the 500 mb trough, vorticity maximum or low center.

SUMMARY

- Average Humidity/Maximum wind analysis
  - The area where the surface to 500 mb average relative humidity $\geq$ 70%
  - The area where the 850 mb and 500 mb maximum wind bands intersect.
- 1000/500 mb Thickness – Heavy snow usually occurs along the thickness ridge between the 5,310 and 5,370 meter thickness lines.

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SUMMARY

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  - The area of maximum snowfall:
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SUMMARY

- Post Cold Frontal Trough
  - Area of maximum snowfall:
    - Located between the 850 and 700 mb short wave troughs
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SUMMARY

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